AFGL-TR-81-0153
ENVIRONMENTAL RESEARCH PAPERS, NO. 743

Specification of Cloud Amount Over Local Areas From GOES Visual Imagery

THOMAS J. KEEGAN
MICHAEL NIEDZIELSKI

28 May 1981

METEOROLOGY DIVISION PROJECT 6670
AIR FORCE GEOPHYSICS LABORATORY
HANSCOM AFB, MASSACHUSETTS 01731

AIR FORCE SYSTEMS COMMAND, USAF

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

John Howard

Chief Scientist

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFGL-TR-81-0153	2. GOVT ACCESSION NO. AD-A109 325	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SPECIFICATION OF CLOUD AMOUNT OVER LOCAL AREAS FROM GOES VISUAL IMAGERY		5. TYPE OF REPORT & PERIOD COVERED Scientific. Interim.
		6. PERFORMING ORG. REPORT NUMBER AFGL ERP ~~No.~~ 743
7. AUTHOR(s) Thomas J. Keegan, Michael Niedzielski*		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Air Force Geophysics Laboratory (LY) Hanscom AFB Massachusetts 01731		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62101F 66700804
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory (LY) Hanscom AFB Massachusetts 01731		12. REPORT DATE 28 May 1981
		13. NUMBER OF PAGES 61
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release, distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

*System and Applied Sciences Corp.
6811 Kenilworth Ave.
Riverdale, MD 20840

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Satellite imagery
Cloud cover
Meteorology
Cloud specification
Cloud albedo
Ground albedo

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Albedos derived from GOES visual imagery data are compared with the cloud cover reported at seven sites in the northeastern United States in the spring through autumn of 1977 and 1978. The data sample was closely edited to remove all cases containing unexplainable inconsistencies between the satellite and surface data. Statistics were generated for the aggregate of stations for the spring/summer and autumn periods separately, as well as the two years separately. The seasonal data were further divided into those cases

next page

DD FORM 1 JAN 73 1473

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

4/1518

20. Abstract (Continued)

that contained predominantly ice crystal clouds or water clouds. The characteristics of the satellite data were computed for a 9 by 9 one-mile pixel box and were the average, maximum and minimum albedos, the range of albedo, and the texture. Detailed attention was given to the relationship between average albedo and cloud amounts. Equations were generated for each station for each year for the water droplet clouds during the spring/summer season. There were not sufficient cases to do the same for the autumn of the ice crystal cloud cases. There is a logical, consistent variation in the equations from station to station despite noisy data and a serious shortage of data throughout most of the scattered and broken cloud cover ranges. A multivariate analysis including infrared characteristics is indicated.

Preface

The author wishes to express his appreciation to Dr. H. Stuart Muench for his counsel and assistance throughout the course of the investigation. Thanks are also due to Mr. Joseph Pazniokas for his careful attention to the preparation of the data, and Ms. Karen Sullivan for speedy and efficient typing of a long series of illegible drafts.

Contents

Illustrations

Tables

Tables

Specification of Cloud Amount Over Local Areas From GOES Visual Imagery

1. INTRODUCTION

The need within the Air Weather Service for computer processing of objective specifications and forecasting techniques has been discussed at length in previous reports[1,2] about this research program. This report presents the results of a test of the extent to which digitized visual imagery from geosynchronous satellites can be used to specify total cloud cover over an area of approximately the same size as viewed by ground based observers. The reason for using GOES data is to enable the investigation to continue on to the mesoscale predictive problem.

The results of this investigation must be regarded as partial since only visual imagery was used in the analysis. There is no doubt that the addition of infrared data will refine the specifications and remove ambiguities that exist within the visual channel. Techniques for processing infrared imagery have been established and programmed, and by the time this report is distributed, the processing and analysis will be underway. Additional improvement will result from the inclusion

---

(Received for publication 26 May 1981)

1. Muench, H.S. and Keegan, T.J. (1979) Development of Techniques to Specify Cloudiness and Rainfall Rate Using GOES Imagery Data, AFGL-TR-79-0255, AD A084 757.
2. Keegan, T.J. (1978) Variation in Ground Brightness Over Northeastern United States as Sensed by GOES Satellite, AFGL-TR-78-0290, AD A068 085.

of data from other IR channels. The poor spatial resolution of microwave data may prevent their application to mesoscale analysis.

The techniques developed in this study should be easily adaptable to data from polar orbiting DMSP satellites. Polar orbiting satellite systems do not provide frequent enough repeat coverage of a given area to allow the computation of any short-range mesoscale forecast statistics. This characteristic of polar orbiter data does not preclude applying any techniques that are developed with GOES data to forecasting with DMSP data once the specification standards have been established. The major difference between the two systems, aside from the sensor characteristics, is the variation in time and space of relative location of the sun, satellite, and point on ground used in making reflectance corrections.

This report examines the albedo variation in the spring, summer, and autumn of 1977 and 1978 at seven stations in the northeastern United States. The stations are Buffalo (BUF) and Syracuse (SYR), New York; Philadelphia (PHL) and Scranton/Wilkes-Barre (AVP), Pennsylvania; Atlantic City (ACY), New Jersey; and Lynchburg (LYH) and Wallops Island (WAL), Virginia. These sites were selected to provide a sampling of inland and coastal, and flat and hilly terrain. Winter data were not used because of the complicating effect of a snow covered background. The inclusion of a 1.55 micrometer snow/cloud discriminator on future satellites should help overcome this complication, but, here again, spatial resolution may limit its value. Statistics are presented by station, season, year, and for the aggregates of stations, seasons, and years. In addition, separate analyses were made for observations that reported primarily ice crystal type clouds because their transluscent nature can be expected to produce lower albedos than a corresponding coverage of water droplet clouds.

2. DATA

2.1 Sample Size

One-mile resolution data were collected for the northeastern United States.[1] The goal was to archive one-mile resolution data during the 40-hour work week. Due to any number of the familiar individual and joint imperfections in the systems involved in the data collection process, some observations failed to make the archive. All told, observations for approximately 770 hours on 121 days were archived during spring, summer, and fall 1977, and 430 hours on 71 days during 1978. For reasons that will be described later, about 35 percent of these observations were rejected from the data sample, which left approximately 750 hours of observations for use in this investigation.

2.2 Sample Format

In a previous study,[2] cloud cover statistics were computed over various subdivisions of a 27 by 27 pixel box. There were not significant differences between the statistics for the entire 27 by 27 pixel box (approximately a 26 by 35 mile area) and the central 9 by 9 pixel box. The assumption was made that the smaller box would better represent the ground-based observer's reports because optical foreshortening is minimized, and (except for a comparative example discussed later in this report) all values are referenced to the 9 by 9 pixel box.

Muench and Keegan[1] describe how the satellite count values are converted to albedo and corrected for solar zenith angle. These albedo values are then processed to generate the statistical characteristics used in this study to define the cloud amount. These characteristics are the average, texture, maximum, minimum, and range of the albedo in the 9 by 9 pixel box at each station for each image. Texture is defined as the standard deviation of the 81 pixels that comprise the box. The term "standard deviation" refers to the dispersion of a sample of individual picture averages of the five characteristics.

2.3 Data Editing

A set of data analyzed to establish standards should contain a low noise level. This objective can be achieved with a small sample of consistently good data or a large enough sample of data containing errors to minimize the effect of this noise on the statistics. In this investigation, where the object is to compare two sets of noisy observations (satellite and ground-based), judicious editing of the data is a necessity, considering the size of the sample.

Several types of editing were applied to the data sample in order to get a set that represented "clean" examples of the cloud categories. The first exclusions were those observations that reported fog or haze that was not associated with a general storm system. These are obviously important weather categories and cannot be ignored in any system which purports to specify cloud conditions. However, radiation fog, which constitutes the majority of the local fog cases, is so sensitive to the local topography, wind velocity, and moisture sources that often it varies considerably even over the comparatively small areas examined herein. Haze, too, can be sensitive to local effects. These obstructions to vision prevent the observer from determining areal extent or the presence of thin or distant clouds thus producing potentially mismatched satellite ground-based observations. For these reasons, fog and haze were set aside for follow-on analysis.

As mentioned earlier, cases when the surface was covered with snow, or lakes were frozen, were not included. The effect of these conditions when the sky is cloud free is striking, and an example is presented in Section 3.4.3.

Following these exclusions, the observations at each station were categorized by the amount of opaque cloudiness recorded on WBAN Form 10 B. The basic data sample consisted of a computer printout, for each station, of the 11 cloud cover categories from clear to overcast, which presented the five albedo characteristics for the larger and small boxes for each observation. The averages and standard deviations of these characteristics also appeared on the printout. If the maximum albedo exceeded 100 percent the observation was removed from the sample. These super albedos result from a breakdown of the zenith angle correction because the sun reflected off the side of a cloud. This occurs mostly at high zenith angles and for this reason all observations when the zenith angle was greater than 70 degrees also have been arbitrarily removed. Even after this adjustment, no doubt there are still many pixels in the sample with erroneously high albedos, but percentage-wise they should be few. The listing made it easy to spot obvious mistakes in which individual characteristics departed so greatly from the mean that either the observation did not belong in the category, or some large undetected error in the navigation resulted in misplaced albedoes.

Other errors were not so easily identifiable. The rule was adopted that any observation that departed more than one standard deviation from the mean would be examined in greater detail. This examination consisted of first checking the surface observation to verify that the opaque cloud cover category was correct. Next, a listing of the albedo and texture in each of the other eight subdivisions of the large box was examined. Often it was apparent that the distribution of the cloudiness supported the validity of the observation. For example, a low overcast at the station could prevent the observer from seeing or reporting a sharp clearing line several miles away. The reverse situation could also occur as a sharply edged low cloud deck advances into the area. These types of observations remained in the sample because they represent what the observer could see. Also preserved in the sample, at this point, were cases when ice crystal clouds predominated. There were also cases of cumulonimbus clouds that significantly contributed to raising the average albedo above what would be expected for the reported cloud amount. They stayed in the sample.

The detailed examination also disclosed some observations that could only be explained by inexperience or carelessness on the part of the observer, so they were discarded. A final category of discarded data contained biases or at least unusually systematic errors. No attempt was made to establish whether the cause was attributed to a particular observer, the extent of the sky observable from inside the observer's building or buildings, or topography which restricted the view along the skyline. For example, albedo characteristics representative of 20 percent or 30 percent cloud cover at other stations often are associated with reports of broken clouds at Wallops Island. When the data are examined in detail it is apparent that the clouds are over the missile range only and even there albedos are not typical of broken cloudiness at other stations. A similar situation exists at Buffalo where clouds to the north often seem to go undetected.

A listing of the remaining data, their averages and standard deviations became the data set. Table 1 compares typical averages and standard deviations before and after editing. There is a general tendency with editing to lower the average albedoes, but by and large, the errors were random so the changes were small. Detailed examination of the data generated subjective impressions about seasonal changes in ground albedo and the effects of ice crystal clouds. As a result, further stratification of the data separated autumn cases from those of spring and summer and cases of predominantly ice crystal clouds from those of water or mixed cloudiness.

Table 1. Average Albedo and Standard Deviation, σ, in Percent as a Function of Cloud Cover, N, for a 9 X 9 Array of Pixels at Syracuse for all Clouds and Months in 1977 Before and After Editing Data

N	Clear	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Before Edit											
Albedo (%)	12.9	12.9	16.3	17.6	20.8	24.3	26.3	31.2	36.8	46.2	59.5
σ (%)	3.6	2.7	6.4	8.2	7.6	9.2	10.1	11.1	8.9	12.9	13.7
After Edit											
Albedo (%)	11.9	12.6	14.7	17.3	19.3	20.8	26.0	27.4	35.7	41.1	57.7
σ (%)	2.1	2.2	3.1	8.2	6.4	5.7	8.0	5.1	8.1	10.0	11.9

3. GENERAL DISCUSSION

In order to provide a benchmark for the ensuing discussions, Figure 1 shows the average values of the five characteristics in the 9 X 9 box for all the observations used during 1977 and 1978. "A" is the normalized albedo which is basically the satellite imagery count value expressed as an albedo as defined in Bristor,[3] corrected empirically for calibration drift and normalized for solar zenith angle. "T" is the texture as defined earlier, "M" is the maximum, "m" the minimum, and "R" the range. The values represent the average of all the central 9 x 9 pixel boxes for all the data. The total number of cases in each cloud category is indicated numerically on the graph.

3. Bristor, C. L., Ed. (1975) Central Processing and Analysis of Geostationary Satellite Data, NOAA-TM-NES-64, Washington, D.C.

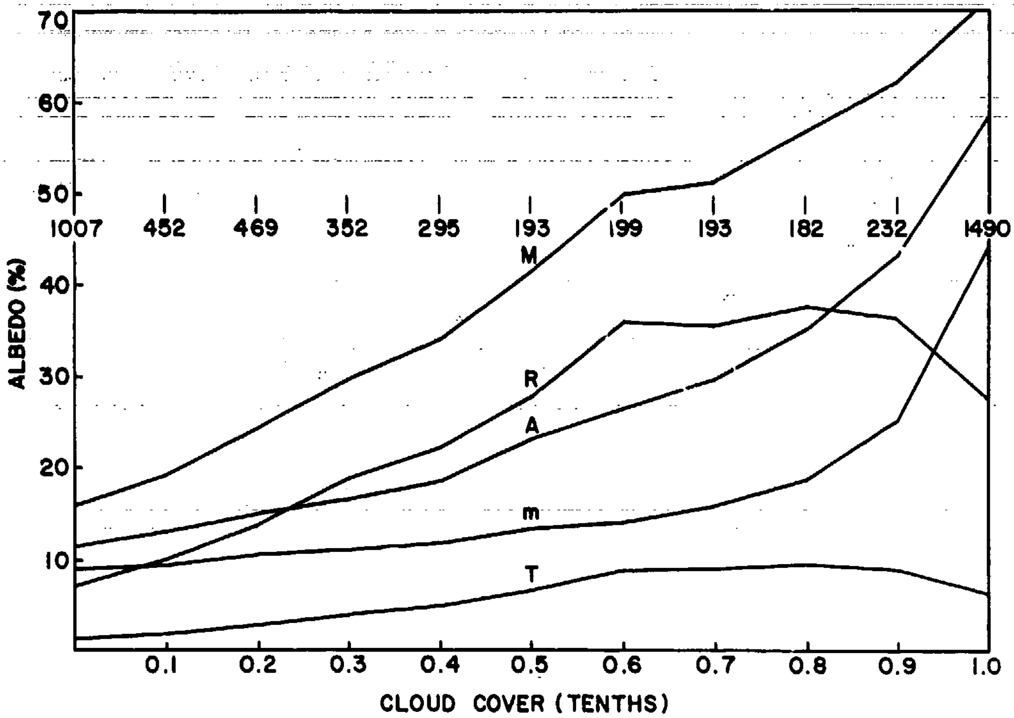


Figure 1. Average (A), Maximum (M), Minimum (m), Texture (T), and Range (R) of the Albedos of all Observations Used in the Study as a Function of Cloud Amount Observed at the Surface

The "U" shaped frequency distribution of cloud amounts is obvious. If the observations in each category were evenly divided among the stations there would be only 25 to 35 observations in several of the cloud cover categories at each station. When this sample is further subdivided into spring/summer or fall, and water or ice clouds, there are many categories at some stations that have only a few cases and even some that have none. This shortfall in the data sample prevented stratifying the sample by individual months and makes the single station statistics weak in the midrange of cloudiness. Curves were computed for the albedo, A, vs. cloud amount, N, relationship and found to be logarithmic in albedo and quadratic in cloud amount. Figure 2 shows the shape of the curves and also illustrates the interannual and seasonal variation. The data represent both water and ice crystal clouds for March through August of 1977 and 1978 and late September through November of 1977. There were not enough autumn data in 1978 to justify fitting a curve. The difference between the curves for spring/summer in 1977 and 1978 could result from differences in the cloud population sampled, differences in the monthly and hourly distribution of observations, or

ALL STATIONS, ALL CLOUDS

SPRING/SUMMER 1977 $\ln A_N = 2.41 + .83N + .80N^2$

$$N = [.27 + 1.25(\ln A_N - 2.41)]^{1/2} - .52$$

1978 $\ln A_N = 2.53 + .86N + .67N^2$

$$N = [.41 + 1.49(\ln A_N - 2.53)]^{1/2} - .64$$

1977/78 $\ln A_N = 2.45 + .83N + .77N^2$

$$N = [.29 + 1.29(\ln A_N - 2.45)]^{1/2} - .54$$

AUTUMN 1977 $\ln A_N = 2.65 + .77N + .62N^2$

$$N = [.38 + 1.61(\ln A_N - 2.65)]^{1/2} - .62$$

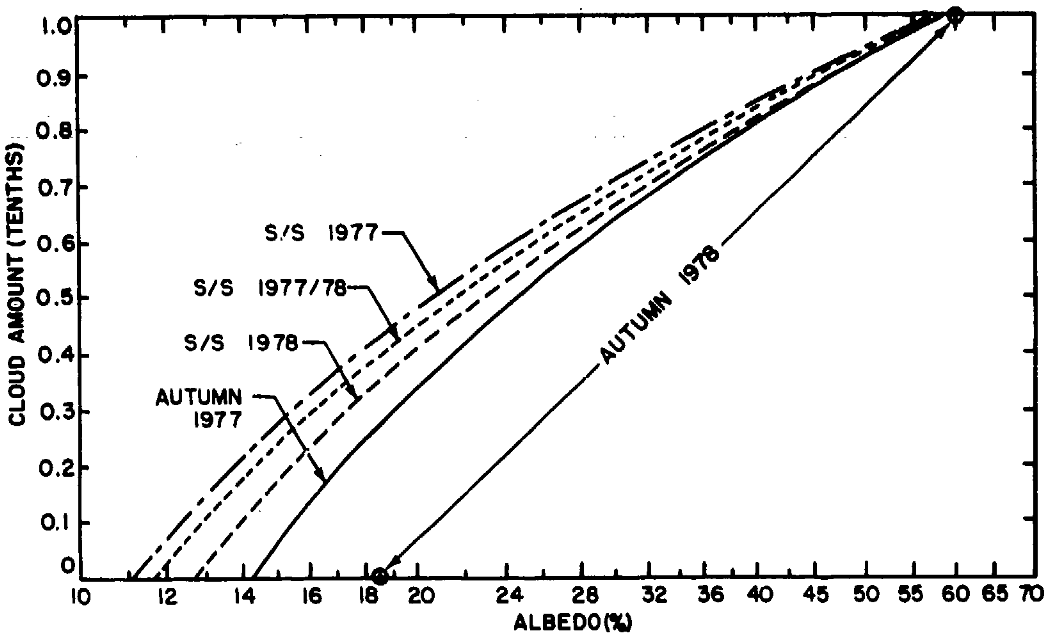


Figure 2. Cloud Amount as a Function of Average Albedo for the Spring/Summer of 1977 (Long and Short Dashes), 1978 (Dashes), Both Years (Dotted) and the Autumn of 1977 (Solid). Values of the albedo for clear and overcast in the autumn of 1978 as indicated by "Xs." Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo

from instrumental differences not accounted for in the corrections for calibration drift of the GOES-1 and GOES-2 satellites used during 1977 and 1978, respectively. Most probably it is the last reason. The cloud amounts determined from the two curves vary from 0 in 1978 to 0.15 in 1977 at A equals 12.5 percent, and from 0.99 in 1978 to 1.0 in 1977 at A equals 57.0 percent. Since the difference in A between the two years is nearly constant, adjusting the curve more accurately for individual satellites should produce acceptable results. The values of A in autumn 1977 for small values of N are much higher than the corresponding spring/summer values. At the larger cloud values, where the ground color does not influence the overall albedo, the three curves essentially coincide. The large difference between the autumn of 1977 and 1978, at small cloud amounts, must remain unexplained at this time.

3.1 Ice Crystal Cloud Effects

Earlier studies[4] suggested that high thin clouds not only added nothing to the albedo, but small amounts actually seemed to lower it slightly below clear sky values. To examine this impression more objectively, cases of predominantly high cloudiness were removed from the sample. The cloud cases that were removed consisted of those reporting a single layer of clouds at or above 20,000 feet and those cases of broken or overcast clouds above 20,000 feet with no more than scattered clouds reported at lower layers. This stratification will be referred to as ice clouds, and the remainder of the sample as water clouds, throughout the rest of this report. It is true that varying amounts of ice crystal clouds occur above broken and overcast water droplet clouds, but in these cases the opacity of the water clouds will compensate for the translucence of the ice clouds in creating the albedo.

Table 2 compares the average albedo, in percent, as a function of opaque cloud cover for water and ice clouds for the spring/summer (S/S) and autumn period for both years at all stations. (Autumn is primarily 1977 data.) The number of cases is listed in parenthesis.

Examination of the spring/summer pairs discloses that very little difference exists between the water and ice clouds until the cloudiness exceeds 0.6. Above this amount, the albedo of ice clouds shows little increase, and an overcast of ice clouds has an albedo corresponding to between 0.7 and 0.8 cloud cover for water clouds. Except for 0.5 cloud cover category, ice cloud albedo is slightly lower than that for water clouds. The impact, or lack of impact, of ice crystal cloudiness is dramatically illustrated by the clear albedos. In the water cloud category the clear albedo represents only the effects of the earth's surface whereas the albedo for ice cloud cases includes amounts of translucent cloudiness as extensive as complete overcast. Nevertheless, the albedos for both categories correspond exactly at clear despite an average translucent cloudiness for the ice crystal cases of 27 percent. It is interesting to note that, in the scattered cloud range, ice cloud cases are more frequent than the water cloud cases even though

4. Muench, H.S. (1981) Calibration of Geosynchronous Satellite Video Sensors, AFGL-TR-81-0050.

Table 2. Average Albedo in Percent and Number of Cases in Parenthesis as a Function of Cloud Cover, N, for Water, Ice, and all Clouds in the Spring/Summer, S/S, and Autumn of 1977/78

	Clear	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
S/S Water	11.6(693)	12.6(170)	14.3(182)	16.4(134)	19.0(104)	22.2(68)	25.8(94)	30.6(101)	34.6(111)	44.9(134)	59.0(999)
Ice	11.6(167)	12.4(212)	14.2(202)	15.9(161)	17.9(136)	24.0(86)	25.7(52)	27.0(44)	30.7(27)	33.6(24)	33.0(29)
Total	11.6(860)	12.5(382)	14.2(384)	16.1(282)	18.4(240)	23.2(154)	25.8(146)	29.5(145)	34.6(138)	43.2(158)	58.3(1028)
Autumn Water	15.4(117)	15.0(34)	17.1(43)	18.5(31)	18.7(32)	22.8(21)	30.0(41)	31.0(39)	37.7(34)	44.8(73)	59.6(459)
Ice	16.9(30)	16.7(36)	18.6(42)	21.0(39)	24.9(23)	28.0(18)	28.0(12)	26.3(9)	34.9(10)	30.2(1)	42.2(3)
Total	15.5(147)	16.1(70)	17.9(85)	19.9(70)	21.2(55)	25.2(39)	29.6(53)	30.1(48)	37.1(44)	44.6(74)	59.5(462)

cases of scattered ice clouds above scattered water clouds are included in the water cloud tally.

In autumn, contrasted with spring/summer, the ice crystal albedos are higher (with one exception) out to 0.5 cloud cover. There is no obvious explanation for these differences from the spring/summer values. As noted earlier in the discussion of Figure 2, autumn albedos are higher than those of spring/summer at the smaller cloud amounts, but converge at overcast.

The overall conclusion that one reaches through examination of Table 2 is that ice clouds contribute no more than their "opaque component" to the albedo. It is possible that even their "opaque albedo" recorded herein is high since broken coverage of ice clouds can be "contaminated" with significant amounts of water clouds, yet albedos are lower than for similar amounts of water clouds alone. The introduction of the infrared data into the specification process will not only help remove ambiguities that exist in the visual albedos of water and ice clouds but will refine the overall specification process.

3.2 Texture

As can be seen from examination of Figure 1, texture is a statistic that could supplement average albedo in the specification of cloud cover since it does not correlate well with average albedo. Texture increases with cloud cover at the low end of the scale, peaks, and then decreases as overcast conditions are reached. This is reasonable behavior except that one would expect the peak to be reached at 0.5 cloud cover. The peak actually occurs close to 0.8 cloud cover, which has an albedo about halfway between clear and overcast, suggesting that large clouds have higher albedos than small clouds. The relatively coarse resolution of the archived data may also be a contributing factor.

Table 3 lists the average values of texture corresponding to the albedo values of Table 2. The most notable features of the table is that, with just a few exceptions which may be due to sampling error, the texture of ice clouds is consistently less than water clouds. Averaged over all cloud amounts, it is 65 percent and 75 percent of the water cloud average for the spring/summer and autumn cases respectively. This is not an unexpected result but it should prove helpful along with the infrared in resolving the specification of cloud height or composition. Again it is interesting to note the lack of impact of translucent cirrus on the clear-sky statistics. Additionally, as with the average albedo, a significant contribution to the ice cloud texture statistics can be expected to have been made by the cases that have lower scattered clouds. A sample of uncontaminated cirrus clouds should have even lower textures as well as albedos.

Table 3. Texture in Percent as a Function of Cloud Cover, N, for Water, Ice, and all Clouds in the Spring/Summer, S/S, and Autumn of 1977/78

N	Clear	1	2	3	4	5	6	7	8	9	10
S/S											
Water	1.3	2.5	3.5	5.4	7.2	8.5	9.7	10.0	9.9	9.5	6.2
Ice	1.4	1.5	2.2	3.0	3.1	5.0	7.2	5.8	6.7	5.8	4.7
Total	1.3	2.0	2.8	4.1	4.9	5.5	8.8	8.7	9.3	8.9	6.1
Autumn											
Water	1.5	2.1	2.9	4.0	5.0	6.9	9.5	8.7	9.9	8.9	6.1
Ice	1.6	1.7	2.0	2.6	5.4	5.2	6.9	6.9	7.4	5.2	7.0
Total	1.5	1.9	2.0	3.2	5.1	6.3	6.9	8.2	9.3	8.9	6.1

3.3 Range, Maximum, and Minimum

As can be seen in Figure 1, the general characteristics of range resemble texture; maximum and minimum albedo resemble the average albedo. Because the correlation coefficient between the albedo's range, maximum, and minimum is so high, these features will not be discussed in this report.

3.4 Surface Brightness

The visible albedo or reflectivity of the earth's surface is important optically because it provides the background against which the development of cloudiness is detected. It is important practically because detecting the presence of any clouds has significance for some specific Air Force operations. The albedo of the surface changes with season, type of ground cover, and color of water. Even wind speed affects the albedo of vegetation and water surfaces. Uncorrected aspects of reflectance geometry also affect the albedo.

Table 4 lists the cloudless albedo statistics for spring/summer (S/S) and autumn by individual station and all station composite. The composite averages and standard deviations are computed from all the individual values and not from the station means.

3.4.1 SPRING/SUMMER

Average surface albedo is very consistent among the stations, and its standard deviation is less than 2 percent even though the period contains data from days prior to the leafing of trees through midsummer. Texture is small, averaging 1.4 percent overall. Despite this small variation, effects of the ground

Table 4. Albedo Characteristics for Individual Stations and all Stations for Clear Sky Conditions in Spring/Summer, S/S, and Autumn of 1977/78. Symbols are as defined in text

	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
S/S								
A	11.6/1.2	11.8/1.2	10.8/1.3	12.0/1.7	11.6/1.8	11.4/1.4	11.8/1.8	11.6/1.6
T	1.8/0.5	0.9/0.4	1.0/0.5	1.3/0.3	1.3/0.3	2.2/0.7	1.0/0.5	1.4/0.7
M	14.8/2.3	14.5/2.5	14.2/3.3	15.4/2.3	15.5/2.7	16.8/3.2	15.1/4.1	15.2/3.2
m	6.0/1.6	9.9/1.1	8.7/1.2	8.9/1.7	8.6/1.4	6.8/1.5	9.8/1.5	8.4/2.1
n	89	59	118	142	122	139	191	860
Autumn								
A	17.4/1.6	18.1/2.8	15.6/2.3	15.4/2.8	14.2/2.2	13.2/3.0	15.5/2.6	15.5/2.7
T	2.4/0.6	1.3/0.2	1.4/0.3	1.7/0.3	1.4/0.1	2.4/0.7	1.1/0.5	1.5/0.5
M	21.7/2.2	21.5/3.2	19.3/3.0	18.7/3.1	17.7/2.8	18.8/3.8	18.4/3.0	19.2/3.1
m	10.1/1.6	15.5/2.4	12.7/2.1	11.4/2.5	10.4/1.6	8.5/3.3	13.0/2.2	11.7/3.0
n	16	13	15	23	17	20	43	147

surface are reflected in the station averages. The largest textures occur at Syracuse and Wallops Island because the effects of the coastlines of Lake Oneida and the Atlantic Ocean, respectively, are included in the 9 by 9 boxes. The coastlines of Lake Erie and the Atlantic are not close enough to Buffalo and Atlantic City to effect those stations. In the 27 by 27 boxes, the coastline effects show clearly in the texture where Syracuse, Buffalo, Atlantic City, and Wallops Island average 2.4 percent, while Wilkes Barre, Philadelphia, and Lynchburg average only 1.4 percent. The surface characteristics also affect the maximum and minimum values. Atlantic City and Wallops Island have the highest maximum ground albedos because of the bright sand at these coastal sites. Philadelphia and Lynchburg also have fairly high maximums that are not so easily explained. Philadelphia may be naturally bright or there may be a reporting bias towards noting a few clouds in "Remarks" in borderline cases, rather than reporting scattered clouds. At Lynchburg the maximum albedo was affected by the cases of completely translucent ice clouds in 1978 included in this sample, which yielded a suspiciously high albedo of 20 percent. (See Appendix A, Table A3.) Otherwise Lynchburg would have been close to 14 percent. It appears that the 20 percent value is a sampling error since the maximum albedo for 10 percent opaque ice crystal cloudiness at Lynchburg in 1978 is only 19 percent. In the minimum pixel values the effect of a water body in the samples for Syracuse and Wallops Island shows clearly with their minimum albedos at less than 7 percent, which is 2 percent to 4 percent lower than measured at the other stations.

3.4.2 AUTUMN

In autumn the average, maximum, and minimum albedos all average about 4 percent higher than the spring/summer values. In addition, as noted earlier, the 1978 data, which composes about 35 percent of the sample, seems unusually high. The standard deviations of the average and minimum albedos is approximately 1 percent higher than those of the spring/summer cases. It is possible that the change from the bright fall foliage to bare trees causes a larger sample variation than the spring condition of going from bare trees to green foliage. To verify this, it is necessary to check out a controlled sample for which the foliage colors are well documented. Despite the increases in the albedo values, certain features are consistent with the spring/summer values. Texture is not only approximately equal for both seasons, but the largest texture values at Syracuse and Wallops Island continue to reflect the effect of the coastlines. Likewise Syracuse and Wallops Island have the lowest average minimum albedos in both seasons. These consistencies are to be expected if the differences between seasonal values is truly a manifestation of changes in background color. There is no obvious explanation for the shift in maximum brightness from the sandy coastal sites to the northernmost stations, Buffalo and Syracuse, since snow was not a factor. One characteristic of the radiation geometry that has not been overlooked but avoided at this time is the effect of anisotropic scattering. Kriebel[5] has calculated the increase in albedo at some specific wavelengths as a function of zenith angle. His results are consistent with the higher albedos observed in autumn but a quantitative comparison is impractical at this time.

3.4.3 EFFECT OF SNOW COVER

On March 25, 1977, following a 1.5 inch snowstorm, Syracuse had 5 inches of snow on the ground under clear skies. Four days later, after unseasonably high temperatures, the ground was bare. This clearly documented case allowed a unique assessment of texture and albedo differences for snow covered vs. bare ground.

The albedo statistics at 1900Z for March 25/29 were as follows: A = 42.9/13.9 percent, T = 0.9/1.2 percent, M = 58.0/16.5 percent, and m = 17.0/10.4 percent. In this example the snow has an average albedo equivalent to that of 0.9 cloud cover; but a texture less than that over bare ground. The maximum and minimum albedos are equivalent to the average for 0.8 cloud cover.

It would appear that the small texture and high albedo may be useful in identifying snow fields under cloudless skies. Texture might also provide some information on the presence and amount of clouds, since cloud shadows will have enhanced contrasts against a snow background and maximum areas because of the low sun angles of winter.

4. SPRING/SUMMER CLOUD STATISTICS

Interpretation of the clear sky statistics has been a fairly straight-forward process. The only decision the ground observer had to make to report this condition was to decide when there were enough clouds to report "scattered" and if all the cirrus clouds were translucent.

When the cloud cases are examined there are added complications for the observer that introduce noise into the data sample. Not only does he define the sky cover subjectively, he competes with the systematic biases of other observers. Add inaccuracies resulting from inadequate attention given to routine weather conditions by those for whom weather observations are an assignment supplemental to air traffic control, and the noise level further increases. The analysis is further impeded by the shortage of data throughout most of the scattered and broken

5. Kriebel, K.T. (1979) Albedo of vegetated surfaces: its variability with different irradiances, Remote Sensing of the Environment 8:283-290.

categories. Nevertheless, by comparing the values of the curve in Figure 2 with the appropriate data in Table 2, it can be seen that the equation on which the curve is based fits the data very closely for the average albedo. Similar curves were generated for each station for the individual years. They will be discussed later.

Appendix A contains tables similar to Table 4 for each of the 11 cloud cover categories for water and ice clouds in spring/summer and autumn. There is no need to discuss each one in the detail spent on the clear cases. Several features that merit attention will be discussed; the reader may want to refer to the tables through the following paragraphs.

Although the average albedos for water and ice clouds correspond throughout the range of coverage that includes most reports of ice clouds, this agreement does not hold for the texture and the maximum albedo except under clear conditions. Considering that a partial cover of water clouds is heavily weighted towards cumulus forms that contrast starkly with the background compared with the gentle diffusing effect of cirrus, this result is not surprising. At 0.1 cloud cover the textures for water and ice clouds, respectively, are 2.5 percent and 1.5 percent, and the maximum albedos are 22.2 percent and 16.4 percent. The texture differential peaks at 0.7 coverage where the values are 10.0 percent for water and 5.8 percent for ice clouds. The largest differential between the two types for maximum albedo is 28.4 percent and occurs at overcast when water clouds have a value of 72.3 percent while ice clouds are only 43.9 percent.

Minimum albedo values exhibit an interesting behavior. Under scattered and most broken cloud conditions the minimum albedo is higher for ice than water clouds. This is most likely a result of the lack of strong shadows under cirrus clouds. The differential is a few tenths of a percent at 0.1 cloud cover and peaks near 4 percent between 0.5 and 0.6 coverage. Between 0.8 and 0.9 cloud cover the minimum albedo for ice clouds becomes lower than that of water clouds and, under overcast conditions, the minimum albedo for water clouds is 44.9 percent and for ice clouds 23.6 percent. It is logical to expect that the major contributors to the low albedo values in overcast clouds are pixels in shadows caused by cloud top texture or multiple cloud layers. It is also interesting that the average minimum albedo in water clouds of 44.9 percent is within 1 percent of the average maximum albedo of 43.9 percent in ice clouds. In other words, the albedo of an ice crystal cloud overcast approximates that of the darkest part of an overcast composed of broken or overcast water clouds and, in many instances, varying amounts of ice clouds also.

The very low average minimum albedos for cirrus overcast (keeping in mind that it would be even lower were not the observations contaminated by as much as 0.5 of water clouds) can be ascribed to the streaky characteristic of cirrus clouds which produces many thin areas. This interpretation is consistent with the conclusions in the author's report[6] of 11 flights aboard an Air Weather Service WC-135 searching for extensive (60 km^2) beds of thick, homogeneous cirrus clouds. Stated succinctly, such clouds are difficult to find. Not surprisingly the noise level drops in the data for overcast conditions. The station to station variation of the four statistics is small. The standard deviations of the station averages weighted for the number of cases at each station are A = 1.5 percent, T = 0.8 percent, M = 2.1 percent, and m = 2.9 percent for water clouds. Under partly cloudy conditions these values run as high as A = 5.5 percent, T = 2.5 percent, M = 9.4 percent, and m = 5.9 percent.

5. ALBEDO VARIABILITY

Tables A1 through A4 in Appendix A list the average albedo characteristics and their standard deviations by station, season, and water/ice cloud types for each cloud cover category, for each year. There is no need here to describe this material in detail. Sufficient data appear in the tables for the interested analyst to extract his own particular needs. At this point, only the average albedos will be discussed. Figures 3 through 9 present the 1977 and the 1978 curves of cloud cover, N, in tenths as function of A in percent of water clouds during spring/summer. The standard deviation, σ, and number of cases, n, are listed for each cloud cover category. The curves represent the solution of the equations also present on the figures:

$$\ln A_N = c + bN + aN^2 \qquad (1)$$

where a, b, and c are the constants generated by a least squares solution to data on which Tables A1 through A4 are based. The transposition of the equation which solves for cloud amount is

$$N = [\beta^2 + \alpha\,(\ln A_N - c)]^{1/2} - \beta \qquad (2)$$

where

$$\alpha = \frac{1}{a} \;, \quad \beta = \frac{b}{2a} \;.$$

6. Keegan, T.J. (1972) An evaluation of direct readout infrared data, Monthly Weather Review 100:117-125. AFCRL-TR-72-0343, AD 744 401.

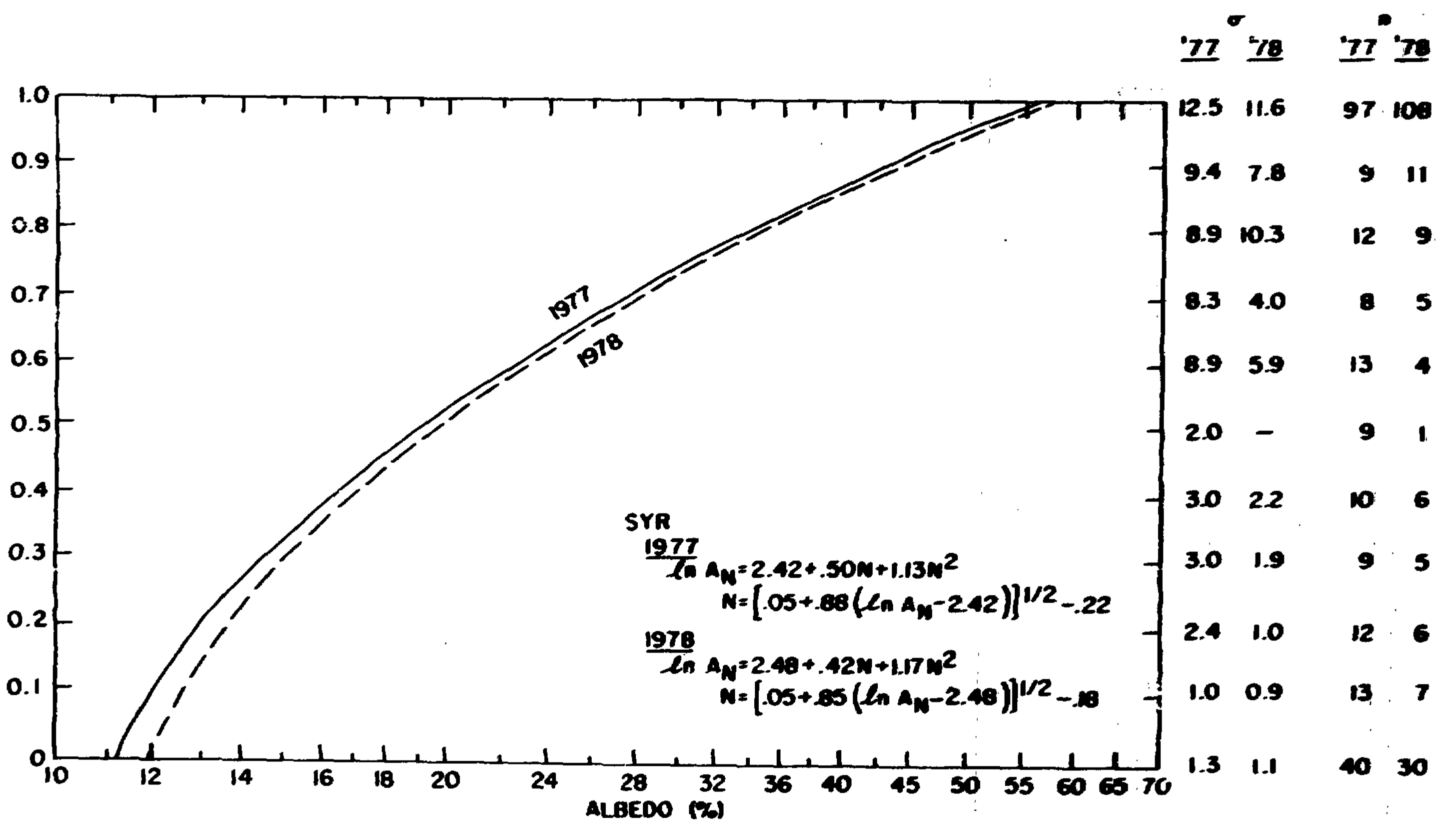


Figure 3. Cloud Amount as a Function of Average Albedo at Syracuse *in the Spring/Summer of 1977* (Solid) and 1978 (Dashed). The standard deviations, σ, of the averages for each cloud amount and the number of cases, n, are listed on the right. Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo

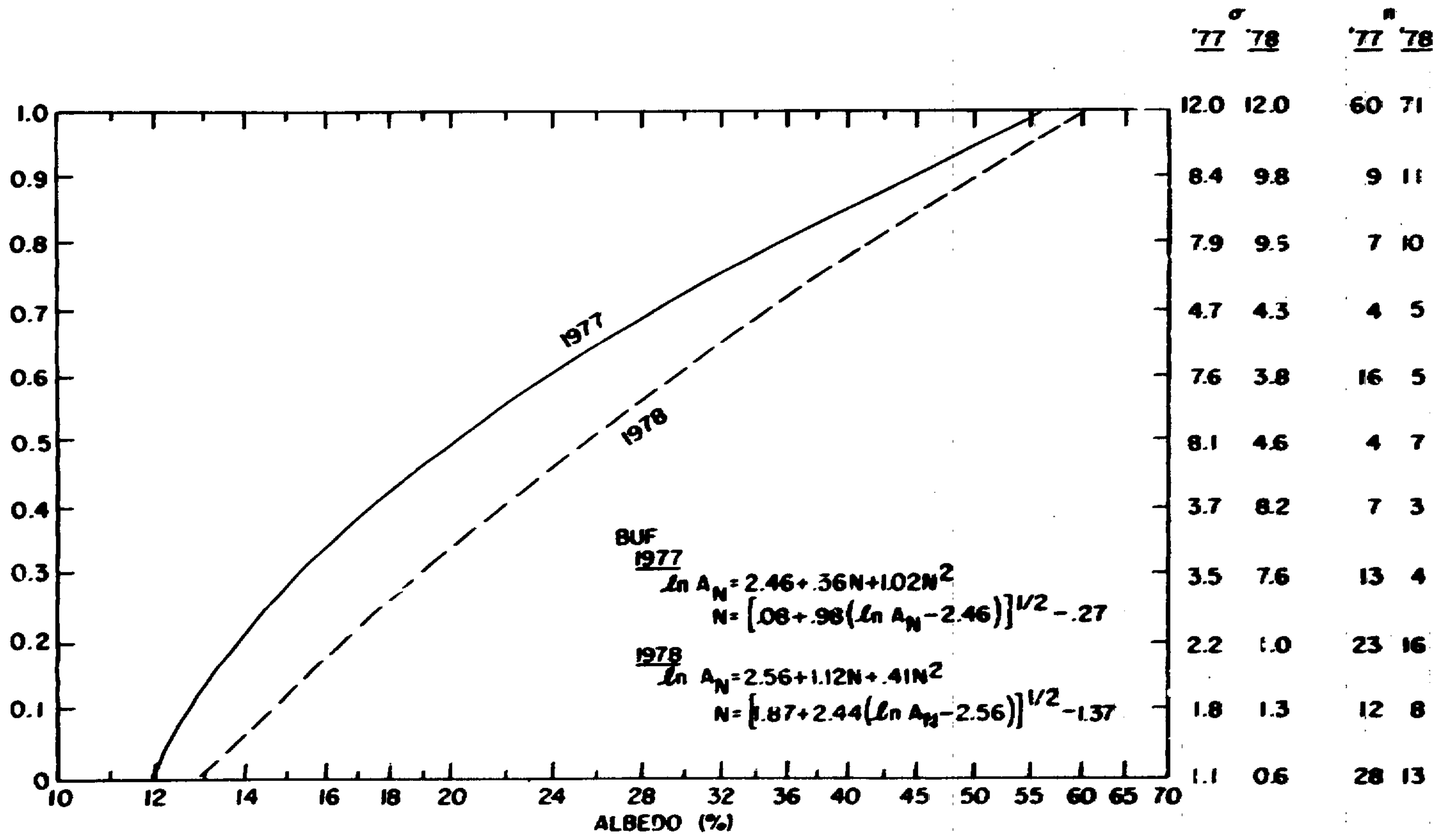


Figure 4. Cloud Amount as a Function of Average Albedo at Buffalo in the Spring/Summer of 1977 (Solid) and 1978 (Dashed). The standard deviation, σ, of the averages for each cloud amount and the number of cases, n, are listed on the right. Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo

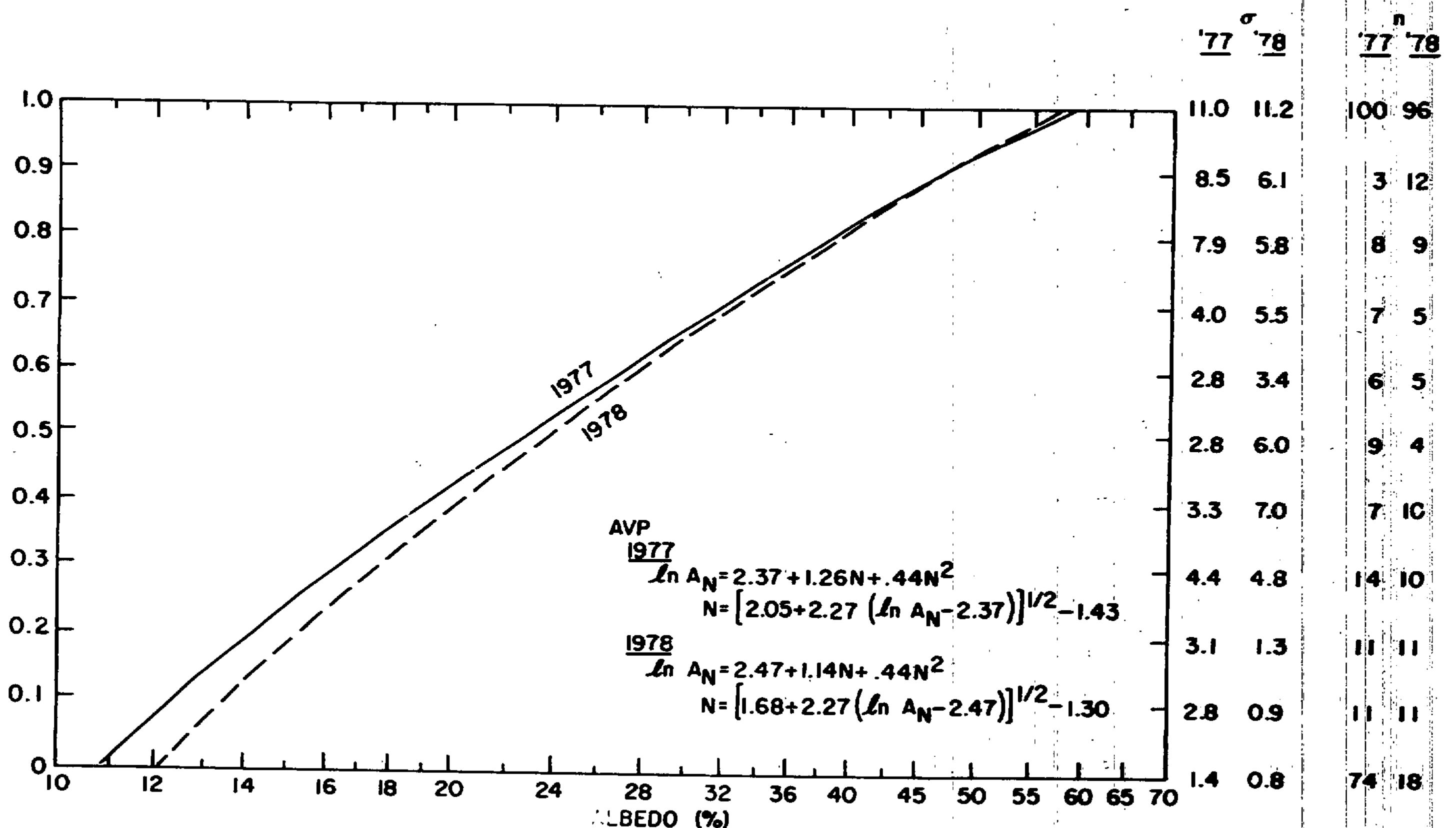
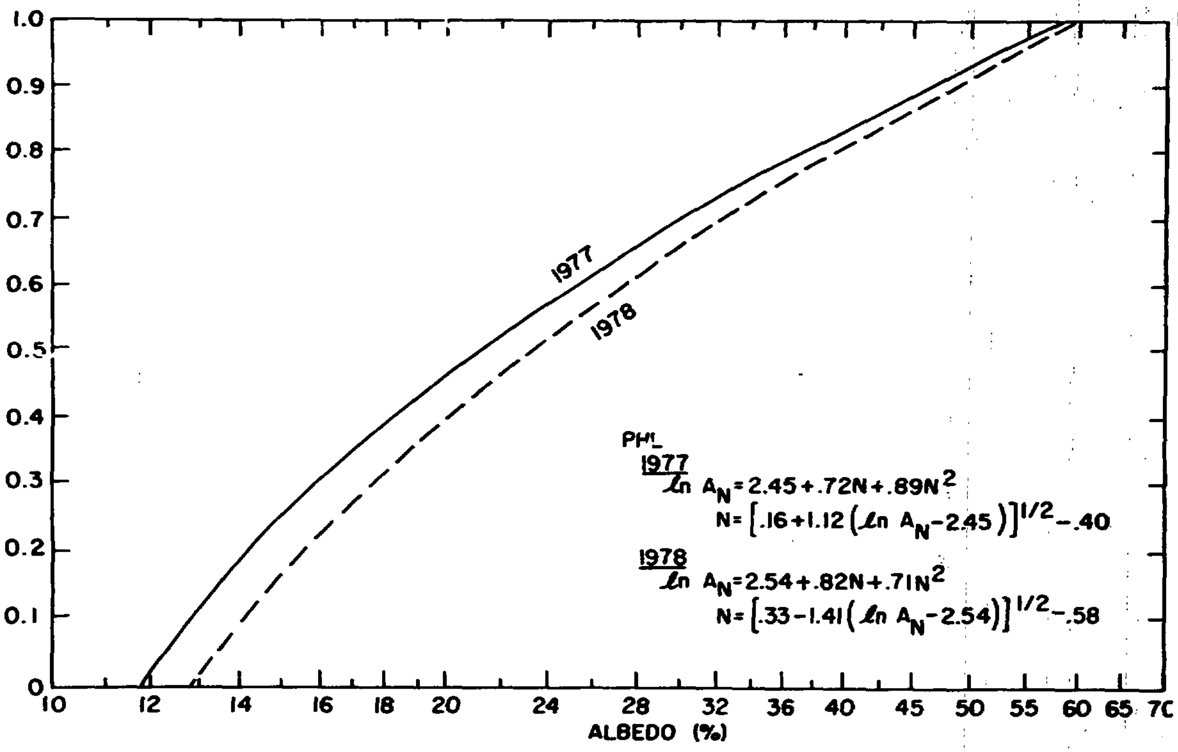


Figure 5. Cloud Amount as a Function of Average Albedo at Wilkes-Barre in the Spring/Summer of 1977 (Solid) and 1978 (Dashed). The standard deviations, σ, of the averages for each cloud amount and the number of cases, n, are listed on the right. Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo



	σ '77	σ '78	n '77	n '78
1.0	10.9	10.5	85	81
0.9	11.9	8.0	15	13
0.8	2.7	11.4	4	11
0.7	7.7	6.9	4	10
0.6	—	5.9	1	4
0.5	3.8	0.5	5	2
0.4	3.0	3.1	6	5
0.3	2.4	2.5	11	12
0.2	2.2	2.1	11	11
0.1	1.9	1.7	12	18
0	1.6	1.8	83	40

Figure 6. Cloud Amount as a Function of Average Albedo at Philadelphia in the Spring/Summer of 1977 (Solid) and 1978 (Dashed). The standard deviations, σ, of the averages for each cloud amount and the number of cases, n, are listed on the right. *Equations of curves are expressed* in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo

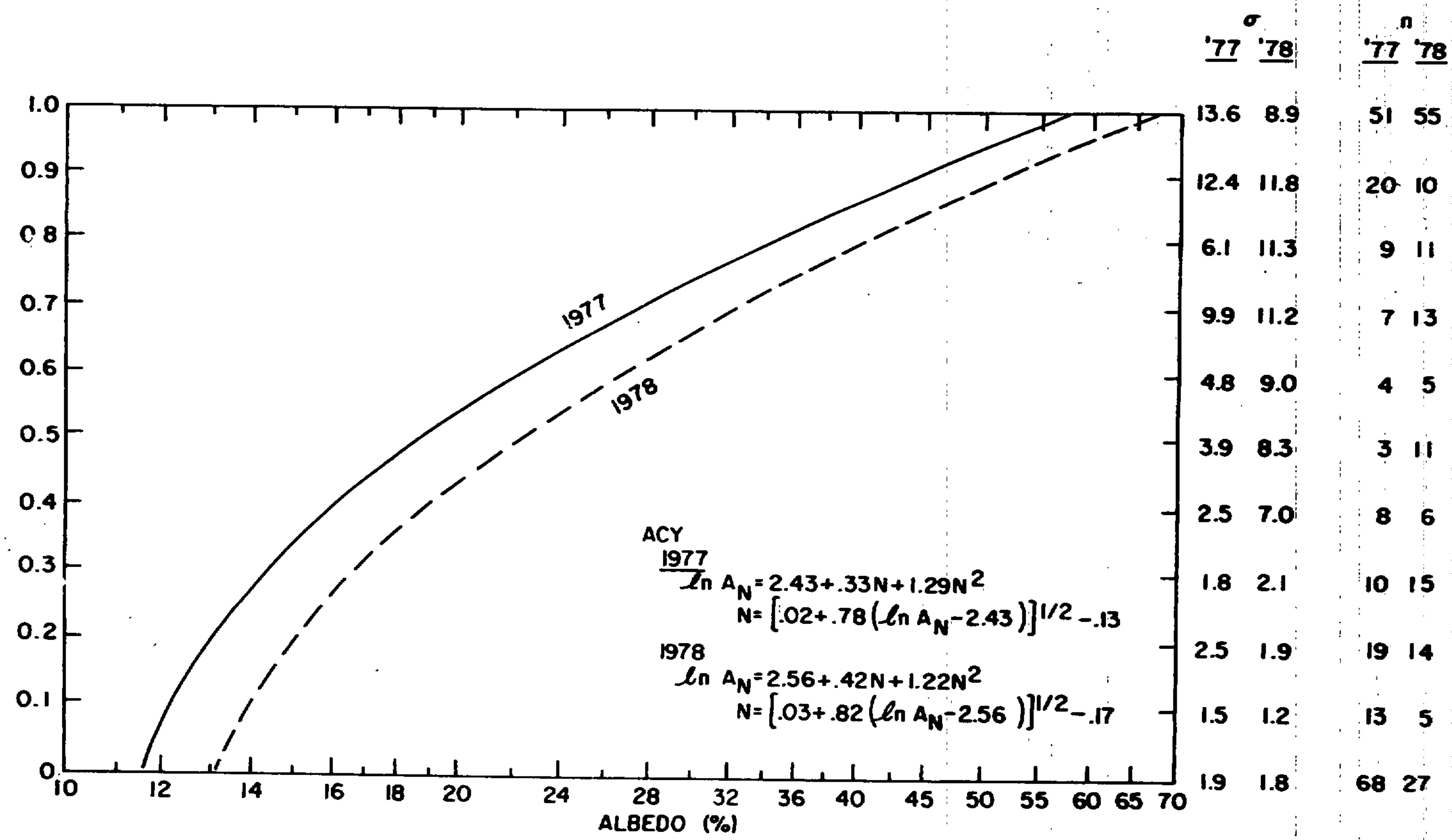
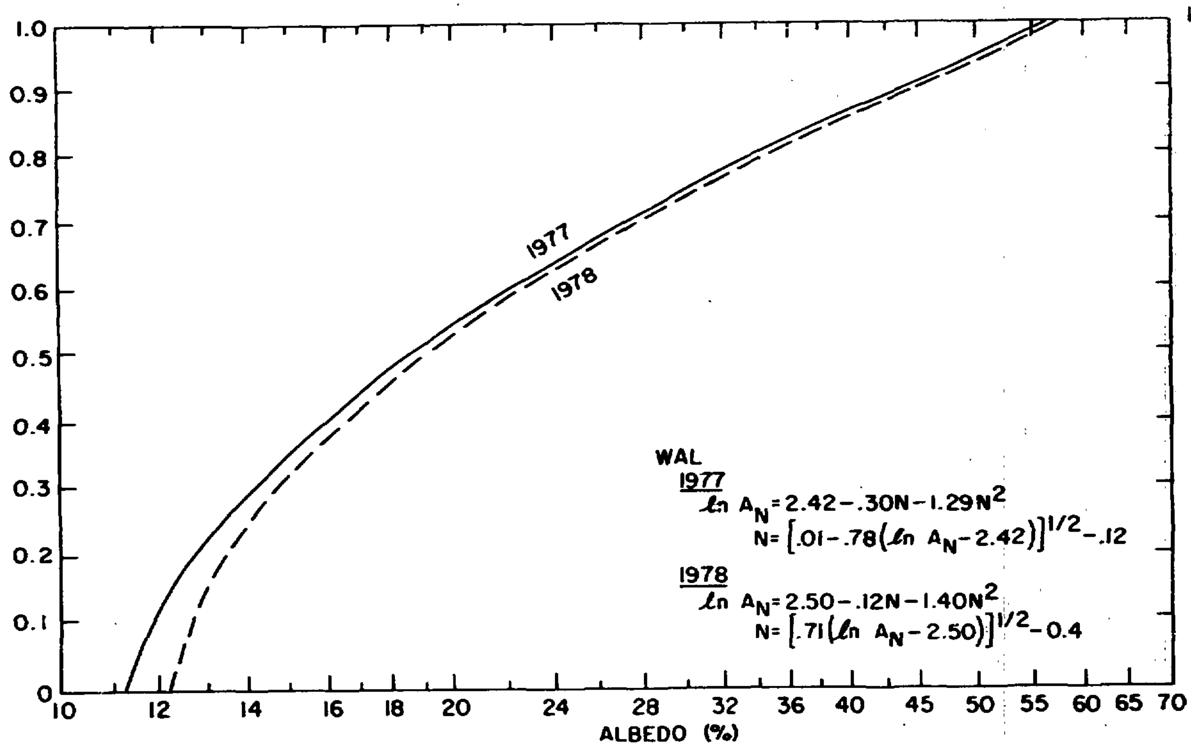


Figure 7. Cloud Amount as a Function of Average Albedo at Atlantic City in the Spring/Summer of 1977 (Solid) and 1978 (Dashed). The standard deviations, σ, of the averages for each cloud amount and the number of cases, n, are listed on the right. Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo



σ '77	σ '78	n '77	n '78
13.8	13.2	35	40
7.8	5.8	3	2
8.6	5.9	6	3
9.2	7.1	9	4
2.7	3.8	3	8
3.6	0.7	3	3
8.1	2.3	12	3
3.1	—	5	0
1.7	2.0	11	4
1.7	0.7	20	9
1.4	1.1	85	30

Figure 8. Cloud Amount as a Function of Average Albedo at Wallops Island in the Spring/Summer of 1977 (Solid) and 1978 (Dashed). The standard deviations, σ, of the averages for each cloud amount and the number of cases, n, are listed on the right. Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo

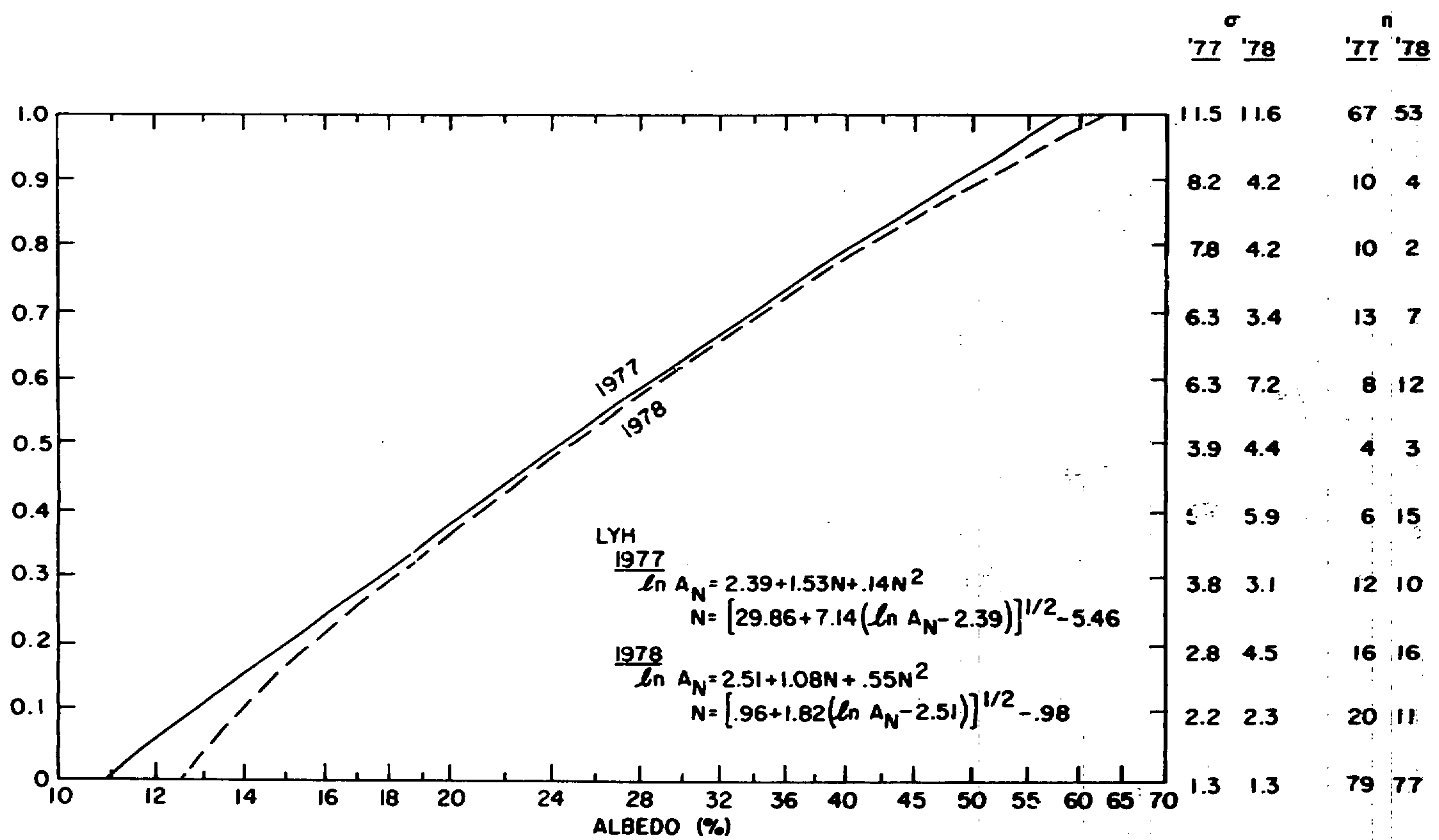


Figure 9. Cloud Amount as a Function of Average Albedo at Lynchburg in the S[illegible]/Summer of 1977 (Solid) and 1978 (Dashed). The standard deviations, σ, of the averages for each cloud amount and the number of cases, n, are listed on the night. Equations of curves are expressed in terms of albedo for an observed cloud amount, AN, and the amount of clouds, N, for an observed albedo

Examination of the curves discloses that the aforementioned higher albedo values in 1978 carry through all the cloud cover categories at all stations with few exceptions. The curves agree well in shape and value, with the exceptions of Atlantic City, which has unusually high values in 1978 compared to 1977, and Buffalo, where both shape and value differ greatly between the years.

Note how much the coefficients for Lynchburg in 1977 differ from those of all the other equations. This is a consequence of the small value of the coefficient a in Eq. (1), which provides the "bow" to the curve.

Perhaps the most important feature that emerges from an examination of the curves is that there are some systematic differences and similarities among them. Wilkes-Barre and Lynchburg, both inland, hilly stations, have very flat curves, while Atlantic City and Wallops Island, both coastal, have bowed curves.

The order of these curves can be seen if we rank the constants a and b of Eq. (1). In Eq. (1), b is a slope factor and a controls the curvature. Since the arguments of Eq. (1) are the reverse of the presentation in Figures 3 through 9, a small value of b is depicted in the figures as a sharply rising line at small values of N.

Table 5 shows separately the 1977 and 1978 values of a and b ordered by increasing values of b in 1977. With the major exception of Buffalo and the minor reversal of the order of Lynchburg and Wilkes-Barre, the 1978 values rank the same as 1977 values. This is an encouraging circumstance. It suggests that, despite the paucity of data in the midrange of cloud cover and the noise in the sample generated by ground observers, instrumental calibration, navigational inaccuracies, and the selection and preparation of data, there are consistencies among the stations and between years. When a grossly anomalous curve (such as that of Buffalo in 1978) appears, it suggests that serious errors have been made either in the observations or the processing the data. At this stage, however, the possibility cannot be ruled out that the predominance of certain cloud type combined with the small number cases available in the midrange of cloud cover produced this effect.

Table 5. Coefficients a and b of Eq. (1) Ranked in Ascending Order of b in 1977

	WAL	ACY	SYR	BUF	PHL	AVP	LYH
1977							
a	1.29	1.29	1.13	1.02	0.89	0.44	0.14
b	0.30	0.33	0.50	0.56	0.72	1.26	1.53
1978							
a	1.40	1.22	1.17	0.41	0.71	0.44	0.55
b	0.12	0.42	0.42	1.12	0.82	1.14	1.08

6. CONCLUSION

This investigation demonstrated that there is a systematic variation to the relationship between visual albedo as measured by geosynchronous satellites and total cloud amount as reported by ground observers. The albedo/cloud cover curves in Figures 3 through 9 show considerable consistency, with the exception of Buffalo, between the two years observations were made. One can also note the similarity in the shape of the curves for stations with similar topography, such as Atlantic City and Wallops Island, and Wilkes-Barre and Lynchburg. It appears possible that the albedo/cloud cover relationship can be established by measuring the clear sky albedo and modifying the curve at a nearby station to fit between that point and the albedo of overcast conditions, ~58 percent.

The important question that remains unanswered at this time is how good these relationships are in specifying the cloud amount from the observed albedo at a specific time. Testing the relationship on independent data will be conducted, but there is no doubt that the curves need refinement with more data. The period from late March to mid-September has obvious changes in ground albedo that should at least affect the specification of scattered cloud amounts. In the absence of a reliable analytical correction for bidirectional reflectance, further subdividing the data into time of day for each month would bring about more accurate relationships between albedo and cloud cover.

However, the average albedo is only one of the variables. There is certainly some information in the other albedo characteristics selected, not to mention more sophisticated descriptors that were not covered in this study. A multivariate analysis is definitely indicated as a necessary step before any significant evaluation can be made.

In the final analysis, however, verification can only be as good as the "truth" against which it is measured. The inaccuracies attendant to the subjective estimation of cloud cover, the varying area of the sky observed, and, possibly, less-than-zealous concern for the condition of the sky when it does not represent an operational hazard by those for whom weather observation is a secondary duty; all contribute to the degradation of verification reliability. Yet the satellite data presents a consistent picture for analysis. It is objective, calibrated, and areal coverage can be controlled. What is needed is a system, based on satellite data, for describing the sky cover in terms that have meaning to the operators. Satellite imagery data could then be entered directly into the decision-making process for some types of operations. The system must exploit the strengths and recognize the weaknesses of the satellite approach. There are many important weather conditions that will never be defined with any semblence of precision by satellite data alone. Some conditions will be suitable for a probabilistic approach and some can be defined with certainty. The technical problem is to learn how to optimize the interpretation of whatever data are available to support an operation. This problem can eventually be solved.

References

1. Muench, H.S. and Keegan, T.J. (1979) Development of Techniques to Specify Cloudiness and Rainfall Rate Using GOES Imagery Data, AFGL-TR-79-0255, AD A084 757.

2. Keegan, T.J. (1978) Variation in Ground Brightness Over Northeastern United States as Sensed by GOES Satellite, AFGL-TR-78-0290, AD A068 085.

3. Bristor, C.L., Ed. (1975) Central Processing and Analysis of Geostationary Satellite Data, NOAA-TM-NES-64, Washington, D.C.

4. Muench, H.S. (1981) Calibration of Geosynchronous Satellite Video Sensors, AFGL-TR-81-0050.

5. Kriebel, K.T. (1979) Albedo of vegetated surfaces: its variability with different irradiances, Remote Sensing of the Environment 8:283-290.

6. Keegan, T.J. (1972) An evaluation of direct readout infrared data, Monthly Weather Review 100:117-125. AFCRL-TR-72-0343, AD 744 401.

Appendix A

Experimental Results

Table A1. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and *Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite* for the Spring/Summer Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category

0.0 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	11.2	11.7	10.7	11.6	11.4	11.2	10.9	11.2	AVG	11.9	12.8	11.8	12.7	12.9	12.2	12.3	12.4
	1.3	1.1	1.4	1.6	1.9	1.4	1.3	1.5		1.1	.6	.8	1.8	1.8	1.1	1.3	1.4
TEXT	1.6	.9	1.0	1.3	1.3	2.2	1.0	1.4	TEXT	2.2	.9	1.2	1.4	1.4	2.2	1.0	1.4
	.5	.2	.3	.3	.3	.7	.3	.6		.4	.1	.9	.2	.4	.8	.6	.7
MAX	14.4	14.2	14.0	15.0	15.1	16.6	13.9	14.9	MAX	15.2	15.1	16.0	16.4	17.0	17.4	15.8	16.1
	2.6	.9	3.0	2.1	2.7	3.4	2.8	2.9		1.9	.9	5.2	2.6	2.8	2.7	4.2	3.4
MIN	6.4	9.8	8.6	8.7	8.5	6.2	8.9	8.1	MIN	5.3	10.9	9.6	9.4	9.4	8.2	10.3	9.1
	1.7	1.1	1.4	1.7	1.3	1.0	1.4	1.8		.8	.5	.6	1.6	1.3	1.2	1.2	2.0
RNG	8.0	4.5	5.4	6.3	6.6	10.4	5.0	6.8	RNG	9.8	4.2	6.4	7.0	7.5	9.2	5.5	7.0
	2.1	.9	2.8	1.4	2.0	3.5	2.3	3.1		1.6	.7	5.1	2.0	2.1	3.1	4.1	3.6
CASES	40	28	74	83	68	85	79	457	CASES	30	13	18	40	27	30	77	235

0.1 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	11.9	12.4	12.0	12.9	12.2	11.1	13.0	12.2	AVG	12.3	13.4	12.3	14.3	12.2	13.0	13.2	13.2
	1.0	1.8	2.8	1.9	1.5	1.7	2.2	2.0		.9	1.3	.9	1.7	1.2	.7	2.3	1.7
TEXT	1.6	1.4	3.4	2.4	1.9	2.4	3.7	2.5	TEXT	2.3	1.4	2.6	2.8	2.1	3.2	2.6	2.4
	.3	1.1	2.7	1.6	.7	1.8	2.4	1.9		.7	.9	1.0	1.8	.9	.8	2.0	1.5
MAX	15.1	16.7	24.6	23.0	19.6	18.7	30.0	21.5	MAX	17.5	18.2	20.9	26.2	19.9	22.3	24.7	22.3
	1.8	5.8	12.6	8.9	5.0	7.7	12.4	10.1		2.4	5.1	5.1	11.5	5.0	5.5	9.0	8.4
MIN	7.0	9.7	8.5	9.3	8.4	7.0	9.2	8.4	MIN	6.1	11.1	9.7	10.2	8.3	7.6	10.1	9.3
	1.8	1.9	1.4	1.8	1.2	1.2	1.4	1.8		1.8	.9	.5	1.5	.3	1.0	1.4	1.9
RNG	8.1	7.0	16.0	13.6	11.2	11.6	20.8	13.1	RNG	11.4	7.1	11.1	16.0	11.6	14.7	14.6	13.0
	1.2	6.0	11.5	8.8	4.2	8.0	12.1	9.7		3.4	4.4	5.0	11.6	4.9	6.1	8.6	8.3
CASES	13	12	11	12	13	20	20	101	CASES	7	8	11	18	5	9	11	68

Table A1. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.2 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	13.2	13.5	14.8	13.9	13.6	11.6	15.7	13.8	AVG	14.2	16.1	15.0	15.3	13.6	13.8	15.5	15.0
	2.4	2.2	3.1	2.2	2.5	1.7	2.8	2.7		1.0	3.5	1.3	2.1	1.9	2.0	4.5	3.1
TEXT	2.1	2.2	4.2	2.6	3.3	2.0	5.1	3.1	TEXT	3.4	3.9	5.0	3.6	2.5	4.6	4.9	4.0
	1.2	2.3	2.6	1.6	2.5	1.0	3.3	2.5		1.8	3.0	2.2	2.0	1.9	4.1	4.0	3.0
MAX	19.6	21.4	30.1	24.0	26.5	18.4	37.5	25.5	MAX	29.4	30.9	35.5	29.1	22.4	29.2	33.6	30.1
	4.8	10.0	11.1	8.3	11.6	6.1	14.4	12.1		12.4	10.6	10.6	10.1	9.4	19.8	15.2	12.9
MIN	8.0	10.1	9.8	9.7	9.3	8.0	10.5	9.5	MIN	7.4	11.6	10.1	10.2	9.8	8.6	10.0	10.0
	2.3	1.4	2.7	1.9	1.2	1.1	1.6	1.9		1.7	1.3	.4	1.9	1.3	1.3	1.1	1.7
RNG	11.6	11.3	20.3	14.3	17.2	10.4	27.1	16.0	RNG	22.0	19.3	25.4	18.9	12.6	20.7	23.6	20.1
	4.4	10.0	11.5	8.3	11.1	5.8	15.1	11.8		13.4	10.6	10.6	10.7	9.6	20.5	15.3	13.1
CASES	12	23	11	11	19	11	16	103	CASES	6	16	11	11	14	4	16	78

0.3 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	13.8	16.1	16.3	16.2	13.5	13.6	17.2	15.4	AVG	16.6	19.5	21.3	16.5	14.8	0.0	19.4	17.6
	3.0	3.5	4.4	2.4	1.8	3.1	3.8	3.6		1.9	7.6	4.8	2.5	2.1	0.0	3.1	4.3
TEXT	3.6	4.1	6.1	4.1	3.4	2.8	7.7	4.7	TEXT	4.8	7.7	10.6	4.8	3.5	0.0	9.1	6.5
	1.9	4.4	3.6	2.2	1.7	2.1	4.5	3.6		.6	8.1	4.6	2.5	2.8	0.0	4.0	4.7
MAX	26.6	29.2	39.3	30.3	27.8	23.6	45.7	32.6	MAX	38.8	41.9	52.0	37.3	29.6	0.0	51.9	40.9
	10.0	15.4	14.6	9.8	7.9	13.1	17.6	15.2		5.6	18.0	16.9	12.2	14.1	0.0	16.1	17.0
MIN	6.7	11.3	9.8	10.6	9.3	8.5	9.3	9.5	MIN	8.9	11.2	9.8	10.4	9.9	0.0	10.7	10.1
	2.3	1.9	1.4	1.2	1.3	1.6	1.5	2.1		1.2	1.8	1.8	1.5	1.4	0.0	1.8	1.7
RNG	19.9	17.9	29.5	19.7	18.5	15.2	36.3	23.1	RNG	29.9	30.7	42.2	26.9	19.7	0.0	41.2	30.8
	9.0	15.7	15.0	9.7	7.7	12.5	18.0	15.2		6.4	18.9	15.6	12.6	13.6	0.0	17.2	17.0
CASES	9	13	14	11	10	9	12	78	CASES	5	4	10	12	15	0	10	56

Table A1. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.4 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	16.8	15.9	18.7	16.8	13.9	19.6	19.9	17.4	AVG	18.5	25.9	21.3	20.0	17.9	16.1	22.9	20.9
	3.0	3.7	3.3	3.0	2.5	8.1	5.1	5.3		2.2	8.2	7.0	3.1	7.0	2.3	5.9	6.3
TEXT	5.2	5.2	7.6	5.0	3.5	6.2	8.5	5.8	TEXT	5.3	13.8	8.5	6.3	4.4	4.5	9.3	7.7
	1.7	3.8	3.4	2.2	3.0	3.7	4.6	3.6		1.6	8.2	3.6	3.4	4.8	2.1	3.6	4.7
MAX	34.1	36.9	44.6	35.5	25.4	37.8	45.9	36.7	MAX	37.8	63.6	49.8	43.6	29.2	27.6	53.0	45.5
	5.6	19.3	13.9	9.3	9.8	17.2	15.2	15.0		8.4	17.7	13.4	14.3	16.7	6.6	12.5	16.6
MIN	7.7	10.2	10.8	10.7	9.2	9.8	10.9	9.7	MIN	10.2	10.7	10.2	13.1	10.6	8.3	11.8	10.9
	2.9	1.3	1.0	.7	.6	4.1	1.8	2.6		2.2	2.8	2.7	2.1	.9	.6	3.5	2.9
RNG	26.4	26.7	33.8	24.8	16.2	28.0	35.0	27.0	RNG	27.6	52.9	39.6	30.6	18.6	19.3	41.2	34.6
	5.6	19.0	14.0	8.6	9.5	15.5	15.6	14.3		6.7	19.5	12.4	14.7	10.7	6.8	13.8	16.6
CASES	10	7	7	6	8	12	6	56	CASES	6	3	10	5	6	3	15	40

0.5 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	16.7	21.1	23.5	17.5	16.3	17.4	27.9	20.2	AVG	14.5	28.8	21.7	22.7	26.8	18.1	21.9	24.6
	2.0	8.1	2.8	3.8	3.9	3.6	3.9	5.6		0.0	4.6	6.0	.5	8.3	.7	4.4	7.2
TEXT	6.4	8.3	10.9	5.4	4.0	4.0	13.7	8.0	TEXT	2.6	8.8	8.3	10.1	9.7	8.3	11.4	9.1
	2.1	4.5	3.4	2.5	.9	1.1	5.0	4.4		0.0	4.5	4.2	1.3	5.8	1.4	2.5	4.3
MAX	38.1	44.9	50.9	38.7	27.8	28.4	59.8	42.8	MAX	20.9	53.0	43.7	55.2	54.4	44.6	55.7	50.8
	6.7	14.7	10.6	11.6	5.3	4.9	10.1	13.6		0.0	13.7	13.1	5.5	14.3	9.9	8.6	14.3
MIN	7.7	11.4	10.4	10.6	10.2	10.1	10.6	9.8	MIN	7.8	17.5	10.5	11.2	14.8	8.2	9.4	12.9
	1.7	2.0	1.0	1.5	2.7	2.2	4.1	2.5		0.0	5.3	.7	.8	4.7	1.3	1.3	5.8
RNG	30.5	33.5	40.5	28.1	17.6	18.4	49.2	32.9	RNG	13.1	35.5	33.2	44.0	40.4	36.3	46.2	37.9
	7.1	12.8	11.0	12.1	3.8	4.4	14.2	13.7		0.0	16.7	12.7	4.6	16.5	8.9	7.4	16.2
CASES	9	4	9	5	3	3	4	37	CASES	1	7	4	2	11	3	3	21

Table A1. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.6 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	25.4	24.7	24.9	21.6	19.7	20.0	29.5	24.9	AVG	24.0	32.7	24.1	28.1	32.1	22.2	26.6	26.7
	8.9	7.6	2.8	0.0	4.3	2.7	6.3	7.4		5.9	3.8	3.4	5.9	9.0	3.8	7.2	7.8
TEXT	12.1	7.7	11.2	6.4	6.2	6.0	9.6	9.3	TEXT	9.4	14.3	10.3	9.8	11.5	7.2	10.2	10.2
	5.3	4.5	4.5	0.0	2.9	2.6	5.6	5.2		4.2	2.5	3.5	4.4	6.2	2.5	4.5	4.6
MAX	60.3	45.3	59.6	44.1	36.2	35.6	50.4	50.3	MAX	53.3	64.4	58.7	53.9	57.8	43.4	52.7	53.8
	17.9	14.3	14.3	0.0	11.9	8.8	14.6	17.1		16.6	4.9	16.4	15.5	13.8	8.7	12.5	14.1
MIN	9.0	13.2	12.0	11.2	10.1	10.6	12.8	11.5	MIN	10.5	12.9	12.5	15.6	13.5	11.6	12.7	12.6
	2.1	3.7	1.6	0.0	1.2	1.4	2.5	3.2		4.1	3.5	2.1	1.5	2.8	2.5	1.8	2.9
RNG	51.3	32.1	47.6	32.9	26.1	25.0	37.7	38.8	RNG	42.8	51.5	46.2	38.3	44.3	31.8	40.0	41.1
	16.8	14.1	13.2	0.0	11.8	10.1	15.2	17.2		13.6	6.9	15.6	15.7	16.2	8.9	12.6	14.1
CASES	13	16	6	1	4	3	8	51	CASES	4	5	5	4	5	8	12	43

0.7 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	27.6	27.7	31.5	30.7	30.3	28.4	28.3	29.0	AVG	22.3	34.1	28.6	31.1	41.1	29.5	28.4	32.4
	8.3	4.7	4.9	7.7	9.9	9.2	6.3	7.7		4.0	4.3	5.5	6.9	11.2	7.1	3.4	9.5
TEXT	7.9	12.7	13.6	9.6	9.7	8.8	8.6	9.8	TEXT	7.8	10.6	13.9	10.0	10.9	9.1	9.8	10.4
	2.7	5.4	4.2	1.2	4.8	3.3	4.9	4.5		3.9	3.2	2.7	6.5	4.1	6.5	2.7	4.8
MAX	50.7	57.5	62.5	53.0	53.1	51.1	50.2	53.3	MAX	44.5	55.9	67.4	53.1	63.1	52.4	57.7	57.2
	9.3	13.4	9.7	4.8	14.3	11.8	13.4	12.5		14.8	9.4	6.3	15.4	11.5	15.3	8.9	13.8
MIN	16.1	12.4	13.6	14.3	13.7	12.5	14.9	14.1	MIN	8.8	17.8	11.9	16.6	18.7	16.5	14.5	15.7
	5.9	1.6	3.1	3.4	4.7	5.2	3.4	4.4		1.3	3.5	1.6	5.5	7.0	8.5	2.8	6.1
RNG	34.7	45.2	49.0	38.7	39.5	38.6	35.2	39.2	RNG	35.8	38.1	55.5	36.5	44.4	35.9	43.2	41.5
	10.3	14.7	12.2	2.0	14.4	12.1	15.4	13.7		14.8	8.1	7.3	18.4	12.4	19.2	9.9	14.9
CASES	8	4	7	4	7	9	13	52	CASES	5	5	5	10	13	4	7	48

Table A1. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.8 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	36.6	30.0	33.5	39.1	27.4	34.1	38.4	34.1	AVG	36.4	44.7	30.6	36.5	40.3	26.6	34.2	37.1
	8.9	7.9	7.9	2.7	6.1	8.6	7.8	8.7		10.3	9.6	5.8	11.4	11.3	5.9	4.2	10.9
TEXT	8.9	11.4	8.6	11.3	11.0	11.5	8.7	9.9	TEXT	9.8	10.2	10.8	9.4	8.7	9.9	11.4	9.8
	5.3	6.2	2.3	4.4	2.9	4.3	3.9	4.5		4.9	5.1	3.9	5.3	3.0	5.9	1.8	4.6
MAX	58.9	56.5	54.1	62.0	55.4	61.7	56.6	57.5	MAX	57.6	66.1	59.2	57.1	58.1	49.8	60.4	59.1
	15.0	20.8	10.1	10.7	13.9	11.2	11.1	14.1		17.8	10.2	12.2	16.7	9.5	17.9	8.3	14.3
MIN	21.3	12.0	18.7	18.2	11.5	14.9	20.7	17.2	MIN	17.8	25.1	15.7	21.1	21.7	9.7	16.1	19.7
	11.7	3.6	5.5	4.9	2.8	6.5	7.6	8.3		4.5	14.8	3.8	12.9	12.1	.6	.9	11.1
RNG	37.6	44.6	35.4	43.9	43.9	46.8	35.8	40.3	RNG	39.7	41.0	43.5	36.1	36.4	40.2	44.3	39.4
	20.2	21.6	9.6	13.9	13.3	13.6	12.2	16.3		18.3	17.7	13.2	19.0	12.5	17.4	9.2	16.5
CASES	12	7	8	4	9	6	10	56	CASES	9	10	9	11	11	3	2	55

0.9 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	43.2	37.7	46.2	45.2	49.9	39.5	45.2	45.1	AVG	37.7	42.4	47.1	46.3	53.3	31.6	46.2	44.9
	9.4	8.4	8.5	11.9	12.4	7.8	8.2	11.3		7.8	9.8	6.1	8.0	11.8	5.8	4.2	10.0
TEXT	10.3	7.4	10.4	9.8	7.3	9.0	10.6	8.9	TEXT	9.6	10.6	11.4	11.6	7.1	6.5	8.1	9.9
	4.7	2.9	3.1	3.0	3.8	3.5	4.7	4.0		4.3	3.4	5.2	3.7	2.6	2.3	3.0	4.2
MAX	68.3	53.0	68.1	65.4	64.7	54.8	65.1	63.5	MAX	60.3	65.7	69.1	68.2	68.9	43.9	63.3	65.6
	11.2	9.5	13.6	11.1	14.3	8.3	11.8	13.0		12.0	7.2	9.2	8.7	9.9	9.2	8.3	10.7
MIN	25.6	20.6	23.9	24.7	33.0	19.5	23.8	26.3	MIN	19.3	22.8	23.5	20.7	39.9	17.5	27.8	24.8
	11.1	9.5	5.3	11.8	13.1	3.9	10.4	12.1		9.9	9.9	10.6	8.8	14.9	1.3	3.7	12.5
RNG	42.7	32.3	44.2	40.7	31.7	35.4	41.3	37.3	RNG	41.0	42.9	45.6	47.6	29.0	26.4	35.5	40.8
	14.3	12.5	15.5	10.6	15.4	10.1	16.5	14.7		17.1	11.7	17.7	12.2	9.5	7.9	11.4	15.3
CASES	9	9	3	15	20	3	10	69	CASES	11	11	12	13	10	2	4	63

Table A1. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

1.0 WATER CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	56.8	57.9	58.9	58.1	56.9	53.8	60.5	57.9
	12.5	12.0	11.0	10.9	13.6	13.8	11.5	12.1
TEXT	6.1	5.8	6.0	6.9	6.4	6.1	5.6	6.1
	3.1	3.1	3.7	3.3	3.5	3.1	3.0	3.3
MAX	69.8	70.7	71.4	73.4	70.1	67.8	72.9	71.2
	11.4	12.5	9.9	11.2	12.9	12.8	12.6	11.8
MIN	43.0	44.9	45.5	42.8	42.2	40.2	47.6	44.0
	15.6	15.9	15.8	15.0	17.3	15.9	13.8	15.7
RNG	26.8	25.8	25.9	30.6	28.0	27.6	25.3	27.1
	12.5	12.8	14.2	13.8	14.1	12.4	13.2	13.5
CASES	97	60	100	85	51	35	67	495

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	60.3	60.7	58.6	58.9	62.0	57.0	64.6	60.2
	11.6	12.0	11.2	10.5	8.9	13.2	11.6	11.5
TEXT	6.9	6.0	7.8	5.7	5.2	5.0	5.0	6.2
	3.5	3.2	4.4	2.8	3.0	2.9	2.9	3.5
MAX	74.8	73.5	74.0	71.6	73.4	68.0	75.8	73.4
	9.6	10.0	8.3	10.2	9.8	14.2	10.9	10.3
MIN	44.4	46.6	41.0	45.4	49.7	45.0	52.3	45.7
	16.6	16.9	17.5	14.5	13.3	15.0	16.2	16.3
RNG	30.4	26.9	33.0	26.2	23.7	23.0	23.5	27.7
	13.3	12.8	16.3	12.1	13.2	13.4	13.1	14.1
CASES	108	71	96	81	55	40	53	504

Table A2. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category

0.0 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	15.3	15.6	14.1	13.5	13.4	12.2	14.3	13.7
	.3	1.8	2.6	.8	1.5	1.7	1.9	1.9
TEXT	1.2	1.2	1.4	1.4	1.4	2.4	1.0	1.4
	.2	.1	.6	.1	.2	.8	.1	.7
MAX	18.0	18.8	17.9	16.7	17.1	17.6	17.0	17.2
	.1	1.8	4.7	1.2	2.4	2.0	2.2	2.3
MIN	11.9	13.1	11.1	9.8	9.9	7.6	12.0	10.5
	1.1	1.6	1.6	1.2	1.5	1.8	1.8	2.4
RNG	6.1	5.6	6.8	6.9	7.1	10.0	4.9	6.8
	.9	.4	3.4	.9	1.8	2.5	1.1	2.5
CASES	2	4	4	11	14	16	28	79

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	18.4	19.8	17.5	20.9	18.8	20.7	18.5	18.9
	1.3	1.9	1.5	1.9	0.0	.5	2.0	2.0
TEXT	2.7	1.4	1.4	1.7	1.4	2.4	1.2	1.7
	.4	.2	.2	.3	0.0	.5	.2	.6
MAX	23.0	23.3	21.3	24.8	23.0	28.4	21.7	22.9
	1.5	2.6	1.5	1.3	0.0	2.4	2.3	2.6
MIN	9.6	17.0	14.7	16.0	16.1	17.0	15.4	14.4
	1.7	1.6	1.5	2.9	0.0	.3	1.9	3.3
RNG	13.3	6.3	6.6	[illegible].8	6.8	11.5	6.3	8.5
	1.8	1.3	1.4	2.0	0.0	2.6	1.3	3.3
CASES	9	8	6	3	1	2	9	38

0.1 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	17.0	15.9	14.7	15.4	16.2	12.5	15.4	14.9
	1.6	2.6	2.4	1.3	1.8	1.2	1.6	2.5
TEXT	2.4	1.5	2.2	1.7	1.6	2.2	2.2	2.1
	1.0	.5	1.9	.3	.2	.6	1.4	1.1
MAX	24.3	22.0	23.0	19.5	20.3	17.2	23.7	21.2
	5.8	5.9	10.0	1.2	1.9	1.5	8.1	6.6
MIN	11.1	13.2	11.5	10.4	10.8	8.0	11.8	10.6
	1.3	2.1	1.0	.0	1.6	1.2	1.4	2.3
RNG	13.2	8.8	11.6	9.1	9.5	9.2	11.9	10.6
	6.5	3.9	9.3	1.2	.3	1.8	7.8	5.9
CASES	6	5	5	2	2	9	4	33

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	0.0	0.0	0.0	0.0	17.7	17.7
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXT	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.0	0.0	0.0	0.0	0.0	0.0	25.9	25.9
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	13.5	13.5
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RNG	0.0	0.0	0.0	0.0	0.0	0.0	12.4	12.4
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASES	0	0	0	0	0	0	1	1

Table A2. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.2 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	16.7	15.6	16.2	18.2	15.9	13.8	20.8	16.7
	2.3	.6	2.0	2.7	2.1	1.1	4.6	2.7
TEXT	2.8	1.5	3.9	2.5	2.2	3.8	3.6	3.0
	1.1	.4	2.4	1.4	.5	.3	1.6	1.8
MAX	25.4	21.5	30.0	27.0	22.2	24.0	30.1	26.6
	6.2	2.3	9.1	6.5	4.7	4.8	8.1	7.6
MIN	9.7	12.7	11.7	12.5	11.1	8.0	14.3	11.4
	2.5	.5	1.7	4.0	1.8	1.8	1.4	2.8
RNG	15.7	8.7	18.3	14.5	11.1	16.0	15.8	15.3
	6.4	2.1	9.3	9.1	3.6	3.1	6.7	8.0
CASES	9	4	12	6	3	2	2	38

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	19.9	21.5	22.8	18.0	0.0	0.0	20.0
	0.0	0.0	0.0	0.0	.4	0.0	0.0	1.9
TEXT	0.0	1.3	3.3	1.4	1.8	0.0	0.0	1.9
	0.0	0.0	0.0	0.0	.3	0.0	0.0	.7
MAX	0.0	23.2	40.2	26.1	27.1	0.0	0.0	28.8
	0.0	0.0	0.0	0.0	6.0	0.0	0.0	7.0
MIN	0.0	17.1	17.9	19.6	14.4	0.0	0.0	16.7
	0.0	0.0	0.0	0.0	.5	0.0	0.0	2.0
RNG	0.0	6.1	22.3	6.6	12.7	0.0	0.0	12.1
	0.0	0.0	0.0	0.0	6.5	0.0	0.0	7.1
CASES	0	1	1	1	2	0	0	5

0.3 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	17.7	17.1	16.8	0.0	16.9	17.5	19.8	17.7
	2.2	1.8	.6	0.0	2.3	2.8	1.5	2.3
TEXT	2.1	2.4	5.1	0.0	4.0	5.6	7.1	4.3
	.3	.4	2.4	0.0	2.1	2.2	2.8	2.7
MAX	24.1	26.0	32.9	0.0	31.1	33.9	46.8	32.6
	3.5	3.8	9.5	0.0	10.1	6.1	11.7	11.2
MIN	12.5	13.2	11.3	0.0	11.2	8.7	13.1	12.0
	.9	1.5	.7	0.0	.8	1.6	.8	2.0
RNG	11.5	12.8	21.6	0.0	19.8	25.1	33.7	20.7
	3.4	2.8	10.2	0.0	9.4	6.0	12.0	11.2
CASES	3	7	2	0	3	4	5	24

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	20.7	0.0	0.0	27.3	19.3	0.0	18.7	20.9
	1.2	0.0	0.0	0.0	.6	0.0	0.0	2.8
TEXT	3.2	0.0	0.0	7.8	1.3	0.0	1.0	3.0
	.4	0.0	0.0	0.0	.2	0.0	0.0	2.2
MAX	30.2	0.0	0.0	64.2	22.7	0.0	21.1	31.6
	6.8	0.0	0.0	0.0	.2	0.0	0.0	14.5
MIN	13.7	0.0	0.0	18.7	15.8	0.0	16.2	15.3
	3.3	0.0	0.0	0.0	1.1	0.0	0.0	2.8
RNG	16.6	0.0	0.0	45.4	6.9	0.0	4.9	16.3
	3.6	0.0	0.0	0.0	1.3	0.0	0.0	13.1
CASES	3	0	0	1	2	0	1	7

Table A2. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.4 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	19.5	20.3	19.6	17.9	18.0	19.4	23.2	19.4	AVG	19.3	0.0	0.0	0.0	0.0	0.0	0.0	19.3
	2.7	3.1	1.7	0.0	3.0	.6	2.2	2.9		2.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5
TEXT	4.8	5.0	5.9	2.6	4.7	5.7	3.4	4.9	TEXT	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.6
	2.0	1.8	1.5	0.0	1.5	1.4	1.7	1.8		.1	0.0	0.0	0.0	0.0	0.0	0.0	.1
MAX	35.3	35.3	41.1	25.8	35.3	34.4	31.6	35.7	MAX	30.1	0.0	0.0	0.0	0.0	0.0	0.0	30.1
	9.3	5.0	8.1	0.0	7.6	5.0	6.5	8.1		.5	0.0	0.0	0.0	0.0	0.0	0.0	.5
MIN	12.0	12.9	12.1	13.7	11.3	9.7	16.4	12.2	MIN	9.6	0.0	0.0	0.0	0.0	0.0	0.0	9.6
	2.2	.4	2.8	0.0	2.7	1.0	.7	2.7		.9	0.0	0.0	0.0	0.0	0.0	0.0	.9
RNG	23.3	22.4	29.0	12.1	24.0	24.7	15.3	23.6	RNG	20.4	0.0	0.0	0.0	0.0	0.0	0.0	20.4
	7.5	4.6	9.4	0.0	8.5	6.0	7.2	8.7		1.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3
CASES	5	3	5	1	7	2	2	25	CASES	2	0	0	0	0	0	0	2

0.5 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	20.7	25.6	27.2	27.1	18.4	20.0	24.7	22.8	AVG	23.2	0.0	0.0	0.0	0.0	21.8	0.0	22.3
	3.6	0.0	2.1	9.9	2.3	0.0	2.8	5.8		0.0	0.0	0.0	0.0	0.0	2.6	0.0	2.2
TEXT	6.8	7.0	8.9	8.5	4.1	5.2	7.5	6.9	TEXT	8.8	0.0	0.0	0.0	0.0	4.5	0.0	5.9
	2.5	0.0	5	2.6	.7	0.0	.8	2.4		0.0	0.0	0.0	0.0	0.0	2.3	0.0	2.8
MAX	46.0	48.0	56.9	51.9	32.8	35.6	47.7	45.7	MAX	48.0	0.0	0.0	0.0	0.0	37.2	0.0	40.8
	12.1	0.0	1.0	9.6	3.5	0.0	3.4	11.1		0.0	0.0	0.0	0.0	0.0	9.4	0.0	9.2
MIN	9.7	16.0	14.9	14.1	12.5	12.7	13.1	12.4	MIN	8.7	0.0	0.0	0.0	0.0	14.6	0.0	12.6
	1.3	0.0	.4	3.8	3.4	0.0	.8	3.1		0.0	0.0	0.0	0.0	0.0	1.1	0.0	2.9
RNG	36.4	31.9	42.0	37.8	20.4	22.9	34.6	33.4	RNG	39.3	0.0	0.0	0.0	0.0	22.6	0.0	28.1
	11.4	0.0	.6	7.6	.6	0.0	4.2	10.2		0.0	0.0	0.0	0.0	0.0	10.5	0.0	11.7
CASES	6	1	2	3	3	1	2	18	CASES	1	0	0	0	0	2	0	3

Table A2. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.6 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	22.8	30.2	38.7	27.5	27.5	28.1	0.0	29.6
	4.6	5.7	8.9	7.3	3.4	3.2	0.0	7.6
TEXT	5.2	7.9	11.8	8.2	9.6	14.8	0.0	9.5
	1.4	4.0	2.6	2.6	2.6	2.4	0.0	3.9
MAX	37.8	54.6	61.7	51.2	52.0	66.8	0.0	54.2
	8.4	16.8	7.9	7.4	7.2	4.3	0.0	12.9
MIN	11.4	17.8	16.2	14.4	13.2	9.3	0.0	14.3
	3.3	4.8	4.4	3.3	1.8	.7	0.0	4.5
RNG	26.4	36.8	45.4	36.7	38.7	57.6	0.0	39.8
	5.2	17.0	5.9	8.8	8.2	5.0	0.0	13.1
CASES	4	8	6	6	7	4	0	35

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	30.9	0.0	0.0	40.4	32.9	0.0	0.0	33.5
	.1	0.0	0.0	0.0	6.8	0.0	0.0	5.8
TEXT	11.9	0.0	0.0	10.1	9.0	0.0	0.0	10.2
	1.1	0.0	0.0	0.0	3.6	0.0	0.0	2.9
MAX	62.1	0.0	0.0	62.6	57.4	0.0	0.0	59.9
	3.7	0.0	0.0	0.0	13.1	0.0	0.0	9.8
MIN	12.9	0.0	0.0	21.5	17.7	0.0	0.0	16.7
	3.3	0.0	0.0	0.0	1.2	0.0	0.0	3.7
RNG	49.2	0.0	0.0	41.1	39.7	0.0	0.0	43.1
	7.0	0.0	0.0	0.0	14.2	0.0	0.0	11.7
CASES	2	0	0	1	3	0	0	6

0.7 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	29.0	32.5	32.1	36.5	27.2	23.7	25.3	29.6
	3.8	5.8	2.4	9.6	6.9	4.8	2.9	7.2
TEXT	10.0	8.7	10.4	6.8	9.6	9.1	6.3	8.7
	4.3	2.6	.7	2.2	5.8	5.7	2.4	4.1
MAX	57.6	55.2	56.7	51.5	52.2	51.3	42.8	53.0
	14.1	10.1	7.2	11.8	15.9	19.8	6.5	14.1
MIN	13.4	18.4	16.5	21.4	14.1	12.4	15.5	15.9
	2.9	2.7	3.5	4.6	1.8	4.7	4.4	4.9
RNG	44.2	36.9	40.2	30.1	38.1	38.8	27.3	37.1
	14.9	8.7	3.7	11.5	16.9	23.5	10.2	15.7
CASES	9	5	2	6	3	5	4	34

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	43.9	0.0	36.9	42.8	39.2	0.0	40.4
	0.0	0.0	0.0	6.6	.9	0.0	0.0	4.8
TEXT	0.0	10.7	0.0	9.6	13.9	12.8	0.0	11.7
	0.0	0.0	0.0	.1	1.3	0.0	0.0	2.0
MAX	0.0	78.1	0.0	65.3	67.8	65.3	0.0	68.3
	0.0	0.0	0.0	2.8	12.1	0.0	0.0	8.5
MIN	0.0	25.9	0.0	18.6	18.2	17.2	0.0	19.5
	0.0	0.0	0.0	.3	.3	0.0	0.0	2.9
RNG	0.0	52.2	0.0	46.7	49.6	48.1	0.0	48.8
	0.0	0.0	0.0	2.4	11.9	0.0	0.0	7.2
CASES	0	1	0	2	2	1	0	6

Table A2. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.8 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	37.1	39.8	41.6	32.4	35.0	36.1	36.3	37.1
	4.7	8.9	0.0	3.1	6.4	3.8	7.0	7.1
TEXT	11.1	7.8	11.5	9.4	11.6	10.9	10.1	9.8
	3.5	2.1	0.0	3.1	2.5	6.2	2.6	3.5
MAX	64.6	57.0	72.2	56.2	58.2	57.1	60.8	59.6
	7.1	9.7	0.0	6.9	8.4	13.0	17.0	11.5
MIN	19.0	22.4	20.2	16.5	15.0	18.0	19.6	19.4
	3.7	6.9	0.0	5.7	1.9	5.4	6.5	6.1
RNG	45.6	34.5	52.0	39.7	43.2	39.1	41.2	40.2
	9.1	8.7	0.0	12.3	7.1	18.3	13.8	12.0
CASES	6	10	1	3	4	3	6	33

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	0.0	0.0	56.2	0.0	0.0	56.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXT	0.0	0.0	0.0	0.0	13.2	0.0	0.0	13.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.0	0.0	0.0	0.0	78.9	0.0	0.0	78.9
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN	0.0	0.0	0.0	0.0	25.9	0.0	0.0	25.9
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RNG	0.0	0.0	0.0	0.0	53.0	0.0	0.0	53.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASES	0	0	0	0	1	0	0	1

0.9 WATER CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	41.3	40.8	48.2	44.2	49.1	45.4	41.4	44.3
	10.5	9.4	11.2	9.0	9.7	2.9	6.5	10.1
TEXT	13.9	8.1	9.4	7.4	6.7	10.8	6.6	8.6
	2.8	2.7	2.4	3.9	2.5	6.1	2.6	3.8
MAX	75.7	59.1	65.1	60.3	63.1	73.3	55.1	63.2
	9.5	11.8	10.8	9.5	11.9	15.9	8.0	12.3
MIN	16.3	23.1	24.8	28.8	34.6	26.8	23.8	25.8
	4.8	6.7	9.2	12.0	12.4	7.2	7.1	10.8
RNG	59.4	36.0	40.3	31.5	28.5	46.4	31.4	37.4
	8.8	11.6	9.0	15.3	10.9	23.1	12.2	15.4
CASES	8	16	10	13	11	2	4	64

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	52.6	59.5	0.0	0.0	46.0	0.0	37.4	48.0
	15.0	0.0	0.0	0.0	10.6	0.0	0.0	12.1
TEXT	10.0	7.7	0.0	0.0	10.5	0.0	17.2	10.8
	4.5	0.0	0.0	0.0	4.1	0.0	0.0	4.4
MAX	72.6	75.3	0.0	0.0	63.5	0.0	72.1	67.8
	3.8	0.0	0.0	0.0	13.4	0.0	0.0	11.2
MIN	33.6	43.8	0.0	0.0	24.7	0.0	11.8	27.4
	20.0	0.0	0.0	0.0	8.6	0.0	0.0	14.1
RNG	39.0	31.6	0.0	0.0	38.8	0.0	60.2	40.4
	16.2	0.0	0.0	0.0	11.1	0.0	0.0	13.5
CASES	2	1	0	0	5	0	1	9

Table A2. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Water Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

1.0 WA . CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	59.1	54.2	58.6	59.0	59.9	55.4	59.2	58.2
	10.9	8.7	9.0	10.5	10.2	11.7	11.9	10.5
TEXT	7.0	6.5	6.9	5.7	5.2	6.3	5.5	6.2
	3.2	3.1	3.4	3.2	2.6	3.6	2.5	3.2
MAX	74.1	68.8	73.6	71.9	71.0	69.4	71.5	71.8
	9.7	10.0	7.8	11.1	10.7	11.1	11.8	10.3
MIN	43.0	40.1	42.3	45.9	47.6	42.5	46.3	44.0
	14.9	11.3	14.7	13.3	12.9	15.9	14.3	14.1
RNG	31.1	28.7	31.3	26.1	23.4	26.9	25.1	27.8
	12.3	12.6	13.8	12.2	10.1	13.5	11.0	12.6
CASES	63	48	74	59	58	32	48	382

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	68.6	58.4	67.4	66.3	72.0	67.4	64.4	66.2
	13.3	9.5	13.1	6.6	8.7	7.5	11.4	11.3
TEXT	4.3	6.4	6.5	4.6	5.2	7.0	5.4	5.6
	1.2	3.1	3.7	1.5	1.6	1.4	1.3	2.5
MAX	78.3	72.2	81.1	75.1	83.4	[illegible]	76.1	78.1
	13.7	6.1	13.3	6.7	7.5	7.8	13.0	11.1
MIN	58.8	45.3	51.0	56.2	61.4	54.1	52.6	54.0
	14.8	12.0	16.5	7.8	11.5	9.2	10.9	13.5
RNG	19.6	27.0	30.1	18.9	22.0	28.9	23.6	24.2
	6.2	10.2	17.1	5.1	7.5	4.8	5.4	10.7
CASES	12	12	15	13	10	6	9	77

Table A3. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category

0.0 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	11.5	11.4	10.2	11.0	10.7	10.9	11.1	10.9	AVG	12.1	0.0	12.1	14.0	11.3	12.8	15.2	13.3
	1.1	1.2	.7	1.1	1.5	1.3	1.1	1.2		1.5	0.0	.8	2.0	.5	1.6	1.6	2.1
TEXT	1.4	1.0	1.0	1.3	1.5	1.8	.9	1.2	TEXT	2.1	0.0	.8	1.4	1.4	2.6	1.6	1.8
	.4	.7	.3	.3	.4	.4	.3	.5		.6	0.0	.2	.1	.3	.6	.9	.8
MAX	13.8	14.5	13.6	14.3	15.1	14.8	13.4	14.2	MAX	16.0	0.0	14.4	17.3	14.7	19.4	20.8	17.9
	1.2	4.3	2.1	.9	2.6	2.1	1.4	2.5		2.6	0.0	1.4	1.6	1.1	2.8	5.5	4.2
MIN	6.5	9.5	8.1	8.1	7.9	7.0	9.3	8.2	MIN	6.4	0.0	10.2	10.9	7.7	8.3	12.3	9.4
	1.8	1.1	.6	1.3	1.4	1.0	1.1	1.5		2.0	0.0	.8	1.7	1.2	2.0	1.8	2.9
RNG	7.2	5.0	5.5	6.2	7.2	7.8	4.1	6.0	RNG	9.5	0.0	4.2	6.4	7.1	11.1	8.5	8.5
	1.1	3.8	2.1	1.4	2.3	1.8	1.1	2.6		1.5	0.0	1.2	.8	1.6	3.4	5.7	4.0
CASES	8	18	22	13	21	14	20	116	CASES	11	0	4	6	6	10	15	52

0.1 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	11.5	11.7	12.2	11.4	11.7	12.5	13.0	11.9	AVG	12.4	13.5	13.0	14.0	11.8	12.5	15.7	13.5
	.7	1.0	1.7	1.6	1.7	1.0	2.9	1.8		1.5	1.5	1.0	2.2	1.7	1.4	4.0	2.8
TEXT	1.6	1.1	2.0	1.3	1.2	2.0	1.5	1.4	TEXT	1.9	1.4	1.1	1.6	1.5	2.6	1.3	1.6
	.3	.6	2.1	.3	.2	.7	1.1	.9		.4	1.0	.2	.5	.3	.3	.7	.7
MAX	14.5	15.0	19.0	14.7	15.0	20.0	17.8	15.8	MAX	15.3	17.2	16.3	18.1	15.9	18.3	19.3	17.5
	.9	3.8	9.9	2.0	2.0	5.0	6.3	4.9		1.8	4.5	1.0	3.7	1.5	1.7	5.6	3.9
MIN	6.4	9.2	9.1	8.1	8.9	8.4	10.3	8.6	MIN	6.2	10.5	10.8	11.0	8.4	7.6	12.6	9.9
	1.4	1.4	1.1	1.7	1.7	.4	1.7	1.9		1.1	.7	.9	1.9	1.9	1.4	2.8	2.9
RNG	8.1	5.8	9.8	6.6	6.1	11.6	7.4	7.1	RNG	9.1	6.6	5.5	7.1	7.5	10.4	6.5	7.6
	1.2	3.7	10.3	1.5	1.1	4.6	5.9	4.7		1.3	4.6	1.0	2.4	1.4	1.2	3.2	3.0
CASES	21	21	16	26	36	3	20	143	CASES	7	9	6	8	11	11	17	69

Table A3. *Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG)* of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 *for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category* (Cont.)

0.2 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	14.0	16.5	13.3	12.3	13.7	11.9	14.8	13.7	AVG	15.2	13.8	14.5	15.7	14.8	14.5	16.1	14.9
	2.9	6.5	3.5	1.4	1.9	2.3	2.3	3.1		3.0	.9	3.3	3.7	2.1	1.9	2.0	2.6
TEXT	2.2	3.0	2.5	1.5	1.7	2.2	2.7	2.2	TEXT	1.9	1.2	2.5	2.9	1.8	2.9	2.3	2.2
	1.7	3.9	2.3	.6	.6	.5	1.5	1.8		.3	.4	1.7	2.3	.3	1.2	1.5	1.4
MAX	19.1	23.5	21.9	16.4	18.4	17.8	23.0	19.9	MAX	19.4	17.3	22.2	24.5	19.8	23.8	24.2	21.6
	7.5	12.2	11.8	3.0	3.6	2.8	6.8	7.8		4.2	2.5	8.7	9.6	2.8	5.5	8.8	7.2
MIN	8.5	11.6	9.5	9.0	10.2	7.8	10.6	9.5	MIN	10.2	11.3	10.3	10.9	10.6	9.7	12.3	10.8
	2.6	1.6	2.1	1.6	1.4	2.8	1.4	2.3		3.6	.9	1.9	2.7	1.7	2.4	1.3	2.3
RNG	10.6	11.9	12.4	7.4	8.2	10.0	12.4	10.4	RNG	9.2	6.0	11.9	13.6	9.2	14.1	11.9	10.8
	7.3	11.5	11.0	3.3	3.1	2.2	6.6	7.3		1.3	2.1	8.2	8.7	1.7	6.7	9.2	7.0
CASES	24	7	22	17	20	13	22	125	CASES	11	13	11	9	9	12	14	78

0.3 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	16.8	14.9	15.2	14.5	14.6	13.8	18.9	15.6	AVG	15.9	16.0	0.0	15.3	16.6	16.8	19.9	16.7
	7.8	4.3	3.9	2.1	3.5	3.0	3.2	4.7		3.9	2.9	0.0	3.0	8.1	3.4	2.5	4.4
TEXT	3.3	2.6	3.2	2.1	2.6	3.2	5.3	3.2	TEXT	2.1	2.0	0.0	2.0	2.7	3.2	3.1	2.6
	2.5	1.7	2.6	1.0	2.0	1.8	2.0	2.2		.6	.9	0.0	.7	1.6	1.5	2.2	1.5
MAX	24.4	23.6	23.9	20.9	22.6	22.7	36.8	24.8	MAX	19.7	23.2	0.0	21.4	25.0	26.2	30.1	24.7
	11.6	9.6	9.5	5.4	9.9	7.5	10.0	10.5		4.7	6.4	0.0	6.2	9.8	7.4	9.6	8.4
MIN	9.6	11.1	10.3	10.6	10.2	8.4	12.0	10.3	MIN	11.2	12.6	0.0	11.5	11.5	11.0	15.4	11.8
	4.5	2.6	2.3	1.7	1.5	2.1	2.6	2.8		5.3	2.7	0.0	2.6	3.4	2.4	3.0	3.4
RNG	14.7	12.5	13.6	10.3	12.4	14.4	24.8	14.5	RNG	8.5	10.6	0.0	10.0	13.6	15.2	14.7	12.9
	8.3	7.8	8.4	5.5	8.9	7.5	9.9	9.2		1.4	6.2	0.0	4.2	8.0	6.7	11.1	7.4
CASES	18	8	13	20	21	11	15	106	CASES	4	5	0	5	12	12	4	42

Table A3. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.4 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	18.9	15.6	21.4	16.7	15.2	15.8	20.7	17.0
	6.6	5.1	3.0	4.2	3.2	2.5	1.3	4.9
TEXT	3.6	2.5	4.0	3.4	2.9	4.1	6.4	3.5
	2.1	1.4	.6	1.3	2.0	2.9	2.1	2.1
MAX	30.2	22.0	31.8	28.4	24.8	27.6	38.0	27.5
	12.9	8.0	5.2	7.4	10.8	11.3	7.1	10.9
MIN	12.3	11.1	14.2	11.1	10.6	9.7	11.9	11.3
	4.3	3.6	2.0	3.1	2.0	1.5	2.6	3.2
RNG	17.9	11.0	17.6	17.2	14.2	17.9	26.1	16.2
	10.6	5.7	4.6	6.8	10.2	11.4	8.6	9.8
CASES	17	16	3	13	25	5	8	87

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	17.1	20.7	22.9	16.6	18.7	18.5	18.6	19.5
	2.6	4.5	4.9	2.9	6.1	6.7	2.1	5.3
TEXT	1.6	2.5	2.7	3.6	4.0	4.1	3.7	3.3
	.5	2.0	2.4	2.2	3.0	2.9	2.4	2.5
MAX	20.3	28.7	29.5	28.2	29.3	27.9	29.4	28.3
	4.1	9.8	8.9	11.9	12.1	11.5	9.4	10.5
MIN	12.3	16.8	18.2	10.3	12.3	10.5	12.9	13.8
	3.3	3.3	4.6	.9	3.5	2.1	1.2	4.4
RNG	8.0	11.9	11.3	17.8	17.0	17.4	18.5	14.5
	1.0	9.6	9.9	11.7	11.0	10.4	10.4	10.6
CASES	3	10	9	6	7	9	5	49

0.5 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	23.9	19.9	23.4	22.4	21.2	19.5	25.1	22.8
	6.5	3.1	6.8	7.7	6.1	3.3	11.9	8.1
TEXT	4.3	4.6	6.4	5.3	5.7	3.3	6.8	5.4
	2.8	1.1	2.4	3.6	3.6	1.2	4.3	3.5
MAX	34.1	32.4	39.9	36.0	35.4	28.0	43.1	36.8
	10.1	4.8	10.6	17.9	12.8	3.7	18.8	14.5
MIN	15.1	11.3	13.2	12.7	12.1	12.7	14.0	13.4
	6.4	.7	3.7	3.8	3.0	1.7	4.5	4.4
RNG	19.0	21.1	26.7	23.3	23.2	15.4	29.1	23.4
	10.5	5.0	8.9	17.2	12.0	3.4	16.0	13.3
CASES	12	3	7	8	11	5	14	60

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	20.7	26.6	23.5	18.9	30.5	0.0	20.4	26.4
	6.3	5.3	6.7	1.7	7.2	0.0	2.1	7.4
TEXT	2.9	3.2	4.8	2.4	4.3	0.0	3.3	3.9
	1.1	1.5	2.2	.1	2.0	0.0	.8	1.9
MAX	27.2	34.1	35.6	28.5	43.3	0.0	37.1	36.9
	8.4	7.5	8.2	2.9	10.5	0.0	4.1	10.4
MIN	13.8	21.1	15.3	14.6	21.1	0.0	21.4	18.6
	4.6	3.9	2.4	2.8	9.8	0.0	2.0	7.3
RNG	13.4	13.0	20.3	13.9	22.2	0.0	15.6	18.2
	4.8	4.7	7.7	.1	15.6	0.0	2.1	11.3
CASES	3	4	5	2	10	0	2	26

Table A3. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.6 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	29.5 7.0	28.8 5.0	27.3 4.4	23.1 5.7	19.2 4.4	19.4 3.1	21.0 1.2	24.2 6.5
TEXT	8.0 3.1	6.9 2.9	8.8 4.4	5.1 3.0	5.0 2.7	6.3 1.7	4.5 1.8	6.6 3.5
MAX	49.2 9.4	46.7 5.7	51.8 15.4	35.2 11.1	31.8 10.6	36.4 4.7	33.4 3.8	41.5 13.1
MIN	16.8 3.5	18.0 5.7	15.4 1.1	14.1 2.6	11.2 1.4	10.5 1.6	13.8 3.2	14.2 3.7
RNG	32.4 8.4	28.7 11.4	36.4 15.8	21.1 9.8	20.6 10.6	26.0 4.0	19.6 6.6	27.3 12.3
CASES	6	2	6	4	5	4	3	30

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	23.1 8.5	30.3 3.7	30.4 8.2	28.3 9.9	30.1 10.5	19.6 3.8	28.1 3.0	27.7 8.4
TEXT	4.7 1.0	4.8 1.1	4.4 1.9	10.8 4.7	6.2 2.9	10.1 .1	7.1 3.1	6.5 3.3
MAX	35.7 9.7	44.0 2.8	43.7 3.9	53.4 20.7	43.7 14.1	52.4 .5	44.1 4.5	44.4 11.3
MIN	13.5 6.2	22.9 2.9	23.8 9.6	12.0 1.7	17.8 6.4	9.3 2.2	18.1 5.3	17.5 7.4
RNG	22.2 3.4	21.1 5.0	19.9 7.6	41.4 19.0	25.9 10.7	43.1 1.7	26.0 9.4	26.9 12.1
CASES	3	3	3	2	5	2	4	22

0.7 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	26.9 3.6	23.8 8.0	26.6 7.6	24.9 3.3	25.5 10.4	19.9 2.8	26.8 .2	24.6 8.0
TEXT	8.3 2.2	4.2 2.6	8.9 3.2	5.9 .3	7.3 5.0	5.8 2.3	3.9 .5	6.4 3.9
MAX	46.9 6.6	31.9 10.7	48.7 14.5	37.3 2.7	43.3 17.4	38.0 9.7	35.7 2.4	40.4 14.1
MIN	14.4 .7	15.9 4.9	13.6 1.8	13.3 1.2	13.6 5.7	11.2 .8	19.8 .6	14.2 4.6
RNG	32.5 5.8	16.0 8.3	35.1 12.8	24.1 1.6	29.7 17.5	26.8 9.1	15.9 1.9	26.2 14.0
CASES	2	5	3	2	10	4	2	28

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	27.9 3.1	32.6 4.1	31.7 6.4	35.3 1.6	30.3 9.2	0.0 0.0	22.9 0.0	31.1 6.4
TEXT	3.1 .8	3.5 1.0	3.9 2.7	5.6 1.6	6.7 3.3	0.0 0.0	3.3 0.0	4.5 2.5
MAX	35.6 3.0	40.3 4.7	38.3 10.6	50.2 2.9	43.4 14.1	0.0 0.0	29.3 0.0	40.8 9.9
MIN	23.1 1.2	24.5 5.0	23.8 .5	24.6 4.7	16.5 3.9	0.0 0.0	17.3 0.0	21.8 5.2
RNG	12.5 1.8	15.7 4.5	14.5 10.1	25.5 7.6	26.9 11.6	0.0 0.0	12.0 0.0	19.0 9.8
CASES	2	5	2	2	4	0	1	16

Table A3. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.8 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	26.6	38.0	27.9	45.5	0.0	26.4	43.6	33.0	AVG	30.8	22.7	24.8	29.2	0.0	17.7	30.5	27.8
	2.1	3.0	3.3	0.0	0.0	3.2	2.4	8.1		0.0	0.0	0.0	10.6	0.0	0.0	2.7	8.0
TEXT	7.4	10.0	3.7	18.9	0.0	6.4	11.0	8.3	TEXT	7.6	4.8	1.8	4.9	0.0	2.6	5.4	4.8
	5.2	2.8	.6	0.0	0.0	1.6	7.0	5.6		0.0	0.0	0.0	2.8	0.0	0.0	1.0	2.3
MAX	44.4	53.6	36.3	79.3	0.0	43.4	67.0	50.7	MAX	50.7	34.8	28.5	42.4	0.0	24.1	41.9	39.6
	17.6	.8	2.9	0.0	0.0	3.0	14.3	16.6		0.0	0.0	0.0	15.6	0.0	0.0	2.0	12.2
MIN	16.3	19.0	20.6	8.9	0.0	14.0	27.3	18.8	MIN	17.3	15.0	21.0	20.2	0.0	12.9	20.0	18.9
	1.3	8.0	2.6	0.0	0.0	1.7	8.0	7.1		0.0	0.0	0.0	6.1	0.0	0.0	3.6	4.9
RNG	28.1	34.6	15.7	70.3	0.0	29.4	39.7	31.9	RNG	33.4	19.8	7.5	22.2	0.0	11.2	21.9	20.7
	18.8	8.8	.6	0.0	0.0	3.9	20.9	18.4		0.0	0.0	0.0	12.2	0.0	0.0	4.2	10.2
CASES	3	2	3	1	0	3	3	15	CASES	1	1	1	5	0	1	3	12

0.9 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	24.5	38.7	38.9	22.1	38.3	0.0	41.2	35.8	AVG	0.0	34.1	25.2	31.6	25.5	45.8	25.2	32.3
	0.0	.8	0.0	0.0	5.1	0.0	8.1	8.1		0.0	11.1	0.0	6.0	0.0	11.6	.3	9.8
TEXT	3.7	5.1	4.4	7.3	6.7	0.0	6.1	5.7	TEXT	0.0	2.7	3.7	8.6	6.5	3.3	5.9	5.9
	0.0	2.1	0.0	0.0	1.7	0.0	.3	1.7		0.0	.6	0.0	4.6	0.0	.4	.2	3.8
MAX	32.8	48.6	47.5	33.6	54.9	0.0	54.4	47.7	MAX	0.0	40.8	33.1	51.2	45.0	52.3	42.6	46.5
	0.0	2.7	0.0	0.0	3.9	0.0	6.3	9.1		0.0	10.1	0.0	9.5	0.0	11.9	3.1	10.5
MIN	15.7	28.1	27.8	11.4	24.7	0.0	28.4	24.1	MIN	0.0	29.7	16.3	19.9	14.3	38.1	17.1	23.3
	0.0	4.0	0.0	0.0	7.2	0.0	6.6	7.7		0.0	11.6	0.0	8.4	0.0	13.7	1.3	11.6
RNG	17.2	20.5	19.7	22.2	30.2	0.0	26.1	23.6	RNG	0.0	11.2	16.8	31.3	30.7	14.2	25.4	23.2
	0.0	6.7	0.0	0.0	3.3	0.0	.2	5.7		0.0	1.6	0.0	14.0	0.0	1.8	1.7	12.4
CASES	1	2	1	1	2	0	2	9	CASES	0	3	1	6	1	2	2	15

Table A3. *Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Spring/Summer Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)*

1.0 ICE CLOUDS SPRING SUMMER

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	34.1	30.1	0.0	31.1	0.0	34.2	32.4
	0.0	2.2	9.5	0.0	7.2	0.0	0.0	6.3
TEXT	0.0	6.6	4.9	0.0	4.3	0.0	6.3	5.5
	0.0	3.3	1.5	0.0	1.1	0.0	0.0	2.6
MAX	0.0	47.2	41.6	0.0	43.3	0.0	47.3	[illegible]
	0.0	4.6	9.1	0.0	4.6	0.0	0.0	6.2
MIN	0.0	21.2	21.4	0.0	22.0	0.0	15.6	21.0
	0.0	6.2	6.0	0.0	8.5	0.0	0.0	6.9
RNG	0.0	26.1	20.3	0.0	21.3	0.0	31.7	23.9
	0.0	9.6	4.4	0.0	5.2	0.0	0.0	7.9
CASES	0	6	3	0	4	0	1	14

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	32.2	33.7	36.9	0.0	0.0	30.4	33.6
	0.0	11.3	9.6	11.1	0.0	0.0	3.5	9.8
TEXT	0.0	3.6	4.8	3.8	0.0	0.0	2.8	3.9
	0.0	1.1	2.4	1.1	0.0	0.0	.4	1.8
MAX	0.0	39.8	44.5	47.2	0.0	0.0	37.5	42.9
	0.0	10.0	11.1	7.3	0.0	0.0	4.2	9.6
MIN	0.0	24.2	23.7	30.6	0.0	0.0	25.5	26.0
	0.0	10.1	6.9	12.2	0.0	0.0	3.2	9.3
RNG	0.0	15.6	20.8	16.6	0.0	0.0	12.0	16.9
	0.0	3.2	10.8	5.1	0.0	0.0	2.5	7.7
CASES	0	3	5	4	0	0	3	15

Table A4. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category

0.0 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	16.5	15.2	14.7	15.9	15.9	13.8	15.9	15.6
	1.1	0.0	1.2	1.9	1.3	.6	.6	1.5
TEXT	2.2	1.1	1.4	1.5	1.7	2.5	1.0	1.6
	.3	0.0	.2	.2	.1	.8	.1	.5
MAX	20.8	18.0	17.9	19.2	20.1	18.2	18.9	19.2
	1.6	0.0	1.2	2.3	1.3	1.7	.5	1.9
MIN	10.4	13.7	11.7	11.8	11.4	8.1	13.4	11.5
	1.0	0.0	1.1	1.5	1.0	.4	.4	1.8
RNG	10.4	4.3	6.2	7.4	8.7	10.1	5.5	7.6
	1.4	0.0	.9	1.1	.2	2.1	.3	2.1
CASES	5	1	5	9	2	2	4	28

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	0.0	0.0	0.0	0.0	18.9	18.9
	0.0	0.0	0.0	0.0	0.0	0.0	.0	.0
TEXT	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.4
	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1
MAX	0.0	0.0	0.0	0.0	0.0	0.0	22.7	22.7
	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2
MIN	0.0	0.0	0.0	0.0	0.0	0.0	16.0	16.0
	0.0	0.0	0.0	0.0	0.0	0.0	.1	.1
RNG	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7
	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.1
CASES	0		0	0	0	0	2	2

0.1 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	17.6	0.0	19.0	16.9	15.4	16.9	16.5	16.6
	0.0	0.0	1.3	1.3	1.9	2.9	1.0	2.1
TEXT	2.6	0.0	1.9	1.6	1.5	2.7	1.1	1.7
	0.0	0.0	.6	.3	.3	.6	.2	.6
MAX	23.0	0.0	24.2	20.1	19.5	21.4	19.8	20.5
	0.0	0.0	4.0	1.8	2.0	3.1	.8	2.7
MIN	10.2	0.0	15.0	13.0	11.2	10.4	14.0	12.2
	0.0	0.0	.6	1.1	2.1	3.1	1.4	2.5
RNG	12.8	0.0	9.1	7.1	8.3	11.1	5.8	8.3
	0.0	0.0	3.4	1.7	2.4	1.1	1.2	2.7
CASES	1	0	3	7	11	5	5	32

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	22.1	0.0	0.0	0.0	21.4	21.7
	0.0	0.0	.3	0.0	0.0	0.0	.2	.5
TEXT	0.0	0.0	1.3	0.0	0.0	0.0	1.4	1.3
	0.0	0.0	.1	0.0	0.0	0.0	.1	.1
MAX	0.0	0.0	25.3	0.0	0.0	0.0	24.8	25.1
	0.0	0.0	.1	0.0	0.0	0.0	.2	.3
MIN	0.0	0.0	18.7	0.0	0.0	0.0	17.8	18.2
	0.0	0.0	1.3	0.0	0.0	0.0	.3	1.0
RNG	0.0	0.0	6.6	0.0	0.0	0.0	7.0	6.8
	0.0	0.0	1.5	0.0	0.0	0.0	.5	1.1
CASES	0	0	2	0	0	0	2	4

Table A4. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of *1977* and *1978* for *Ice Clouds*. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.2 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	19.8	18.5	33.8	16.8	16.5	20.7	19.5	19.5	AVG	0.0	0.0	20.0	23.9	21.1	12.2	0.0	19.9
	.8	1.8	9.1	1.3	2.2	4.5	2.8	5.8		0.0	0.0	1.1	0.0	1.5	0.0	0.0	3.6
TEXT	2.4	1.7	8.3	1.4	1.7	2.3	2.7	2.5	TEXT	0.0	0.0	2.6	1.4	1.5	3.7	0.0	2.1
	.7	.6	5.7	.1	.3	.5	1.5	2.6		0.0	0.0	.6	0.0	.2	0.0	0.0	.9
MAX	26.6	23.4	52.7	19.9	20.6	24.8	27.6	26.0	MAX	0.0	0.0	29.0	27.0	25.0	27.7	0.0	26.8
	4.5	5.0	8.6	1.9	2.3	4.0	7.0	9.9		0.0	0.0	2.5	0.0	2.3	0.0	0.0	2.6
MIN	14.3	15.4	21.9	12.6	13.0	15.2	14.8	14.7	MIN	0.0	0.0	15.7	18.8	17.1	6.9	0.0	15.5
	1.0	1.2	8.3	2.2	2.2	5.2	3.7	4.3		0.0	0.0	.8	0.0	1.0	0.0	0.0	3.7
RNG	12.3	8.1	30.8	7.4	7.5	9.6	12.8	11.3	RNG	0.0	0.0	13.2	8.2	7.9	20.7	0.0	11.3
	5.4	4.2	14.6	.3	1.5	1.2	7.2	8.6		0.0	0.0	3.3	0.0	1.5	0.0	0.0	4.9
CASES	3	5	3	2	12	3	8	36	CASES	0	0	2	1	3	1	0	7

0.3 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	29.9	0.0	21.0	20.7	23.2	16.4	19.4	20.1	AVG	0.0	21.4	22.0	21.5	23.7	0.0	25.6	22.2
	12.0	0.0	.4	2.8	0.0	1.9	3.7	6.1		0.0	0.0	6.1	1.7	0.0	0.0	0.0	3.6
TEXT	5.4	0.0	1.5	1.9	6.2	2.1	2.0	2.5	TEXT	0.0	7.1	2.2	2.4	3.1	0.0	3.9	3.0
	2.8	0.0	0.0	.3	0.0	.3	1.3	1.8		0.0	0.0	1.3	.7	0.0	0.0	0.0	1.6
MAX	40.6	0.0	24.9	25.8	38.4	21.2	24.9	26.1	MAX	0.0	37.0	27.0	29.5	30.2	0.0	38.6	30.4
	15.3	0.0	.9	3.2	0.0	2.3	6.7	8.9		0.0	0.0	8.5	5.6	0.0	0.0	0.0	6.9
MIN	16.9	0.0	18.2	16.7	12.5	11.5	15.7	14.8	MIN	0.0	8.6	16.7	16.0	17.8	0.0	20.2	16.1
	3.3	0.0	0.0	1.9	0.0	2.1	2.8	3.4		0.0	0.0	3.2	1.6	0.0	0.0	0.0	3.3
RNG	23.7	0.0	6.7	9.1	25.9	9.7	9.2	11.3	RNG	0.0	28.4	10.2	13.5	12.4	0.0	18.3	14.3
	12.1	0.0	.9	1.3	0.0	1.5	5.5	7.5		0.0	0.0	5.3	6.1	0.0	0.0	0.0	7.0
CASES	3	0	2	4	1	8	10	28	CASES	0	1	3	5	1	0	1	11

Table A4. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.4 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	31.9	0.0	25.3	19.2	19.6	20.0	21.4	24.1	AVG	33.7	0.0	0.0	0.0	0.0	20.6	23.6	26.5
	6.3	0.0	.7	2.7	3.8	0.0	[illegible]	6.7		.5	0.0	0.0	0.0	0.0	0.0	3.0	5.7
TEXT	8.7	0.0	2.5	2.3	2.4	3.0	2.6	4.3	TEXT	8.5	0.0	0.0	0.0	0.0	4.2	7.2	7.2
	3.1	0.0	0.0	1.2	.1	0.0	.5	3.3		3.3	0.0	0.0	0.0	0.0	0.0	3.3	3.3
MAX	51.5	0.0	33.2	26.7	26.0	28.7	29.0	35.2	MAX	54.5	0.0	0.0	0.0	0.0	30.2	48.7	47.5
	6.4	0.0	1.0	7.9	3.5	0.0	4.2	12.1		8.0	0.0	0.0	0.0	0.0	0.0	14.9	14.1
MIN	17.3	0.0	20.4	14.8	14.5	13.6	16.6	16.4	MIN	21.0	0.0	0.0	0.0	0.0	12.2	13.9	16.0
	7.4	0.0	.9	1.9	3.0	0.0	1.7	4.7		.0	0.0	0.0	0.0	0.0	0.0	1.5	3.8
RNG	34.1	0.0	12.8	11.9	11.5	15.2	12.3	18.8	RNG	33.4	0.0	0.0	0.0	0.0	18.0	34.8	31.5
	9.6	0.0	.2	6.8	.4	0.0	2.6	11.7		8.0	0.0	0.0	0.0	0.0	0.0	16.4	13.9
CASES	5	0	2	4	2	1	3	17	CASES	2	0	0	0	0	1	3	6

0.5 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	21.8	0.0	27.3	23.1	19.9	0.0	30.1	25.3	AVG	44.4	0.0	29.1	0.0	0.0	29.4	0.0	34.3
	0.0	0.0	.6	0.0	2.6	0.0	10.4	8.0		13.2	0.0	3.8	0.0	0.0	0.0	0.0	10.8
TEXT	1.5	0.0	6.1	10.3	3.8	0.0	4.6	4.8	TEXT	10.6	0.0	7.6	0.0	0.0	6.7	0.0	8.4
	0.0	0.0	.1	0.0	1.1	0.0	2.4	2.5		1.3	0.0	6.6	0.0	0.0	0.0	0.0	5.0
MAX	25.6	0.0	50.1	47.2	30.8	0.0	41.0	38.5	MAX	77.4	0.0	44.0	0.0	0.0	52.0	0.0	56.5
	0.0	0.0	4.7	0.0	6.6	0.0	13.2	12.0		.6	0.0	15.8	0.0	0.0	0.0	0.0	18.8
MIN	17.5	0.0	20.2	6.1	12.5	0.0	20.9	16.8	MIN	26.0	0.0	16.3	0.0	0.0	17.8	0.0	19.8
	0.0	0.0	1.3	0.0	1.5	0.0	11.0	8.4		5.5	0.0	6.0	0.0	0.0	0.0	0.0	6.9
RNG	8.1	0.0	29.9	41.1	18.2	0.0	20.0	21.7	RNG	51.4	0.0	27.7	0.0	0.0	34.2	0.0	36.7
	0.0	0.0	3.4	0.0	5.4	0.0	9.0	10.0		6.1	0.0	21.7	0.0	0.0	0.0	0.0	19.0
CASES	1	0	2	1	4	0	5	13	CASES	2	0	3	0	0	1	0	6

Table A4. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.6 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	24.4	0.0	24.2	32.0	0.0	24.1	29.0	27.8	AVG	26.0	0.0	27.3	25.0	32.7	0.0	0.0	27.7
	0.0	0.0	0.0	0.0	0.0	0.0	9.0	7.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
TEXT	9.2	0.0	2.4	7.1	0.0	8.3	5.5	6.0	TEXT	4.3	0.0	7.0	4.2	14.9	0.0	0.0	7.6
	0.0	0.0	0.0	0.0	0.0	0.0	1.8	2.3		0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
MAX	50.2	0.0	29.2	51.9	0.0	41.5	44.0	43.6	MAX	38.5	0.0	51.4	34.5	81.4	0.0	0.0	51.5
	0.0	0.0	0.0	0.0	0.0	0.0	8.6	8.8		0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.4
MIN	13.0	0.0	20.1	22.4	0.0	10.7	19.9	18.4	MIN	19.5	0.0	17.0	17.9	15.3	0.0	0.0	17.4
	0.0	0.0	0.0	0.0	0.0	0.0	9.4	7.5		0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5
RNG	37.2	0.0	9.1	29.5	0.0	30.6	24.1	25.2	RNG	19.0	0.0	34.4	16.6	66.1	0.0	0.0	34.0
	0.0	0.0	0.0	0.0	0.0	0.0	6.6	8.7		0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.7
CASES	1	0	1	1	0	1	5	9	CASES	1	0	1	1	1	0	0	4

0.7 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL	1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	0.0	24.5	23.6	0.0	23.4	24.0	AVG	38.9	0.0	32.2	0.0	23.5	0.0	0.0	31.5
	0.0	0.0	0.0	4.5	0.0	0.0	0.0	3.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
TEXT	0.0	0.0	0.0	5.4	3.2	0.0	1.3	3.8	TEXT	11.7	0.0	8.4	0.0	5.6	0.0	0.0	8.5
	0.0	0.0	0.0	.9	0.0	0.0	0.0	1.9		0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
MAX	0.0	0.0	0.0	40.0	32.8	0.0	25.9	34.6	MAX	57.4	0.0	54.5	0.0	41.7	0.0	0.0	51.2
	0.0	0.0	0.0	3.1	0.0	0.0	0.0	6.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9
MIN	0.0	0.0	0.0	13.2	18.0	0.0	20.4	16.2	MIN	20.3	0.0	18.8	0.0	14.5	0.0	0.0	17.9
	0.0	0.0	0.0	.3	0.0	0.0	0.0	3.1		0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
RNG	0.0	0.0	0.0	26.8	14.8	0.0	5.5	18.5	RNG	37.1	0.0	35.7	0.0	27.1	0.0	0.0	33.3
	0.0	0.0	0.0	2.8	0.0	0.0	0.0	9.2		0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
CASES	0	0	0	2	1	0	1	4	CASES	1	0	1	0	1	0	0	3

Table A4. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

0.8 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	43.3	0.0	46.1	32.5	31.2	0.0	30.8	38.3
	0.0	0.0	3.3	0.0	0.0	0.0	0.0	7.2
TEXT	8.3	0.0	7.6	10.2	8.6	0.0	4.8	7.8
	0.0	0.0	1.5	0.0	0.0	0.0	0.0	1.8
MAX	70.1	0.0	60.6	54.9	47.1	0.0	39.6	55.5
	0.0	0.0	5.6	0.0	0.0	0.0	0.0	10.4
MIN	26.2	0.0	29.2	13.0	18.4	0.0	23.8	23.3
	0.0	0.0	2.3	0.0	0.0	0.0	0.0	6.0
RNG	43.9	0.0	31.4	42.0	28.6	0.0	15.9	32.2
	0.0	0.0	3.3	0.0	0.0	0.0	0.0	9.4
CASES	1	0	2	1	1	0	1	6

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	48.4	25.3	0.0	0.0	36.7	36.8
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.4
TEXT	0.0	0.0	3.3	6.5	0.0	0.0	7.0	5.6
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
MAX	0.0	0.0	56.0	45.1	0.0	0.0	50.7	50.6
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4
MIN	0.0	0.0	41.4	17.3	0.0	0.0	20.9	26.5
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6
RNG	0.0	0.0	14.6	27.8	0.0	0.0	29.7	24.1
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7
CASES	0	0	1	1	0	0	1	3

0.9 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	30.2	0.0	0.0	0.0	0.0	0.0	30.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXT	0.0	5.2	0.0	0.0	0.0	0.0	0.0	5.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.0	45.9	0.0	0.0	0.0	0.0	0.0	45.9
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN	0.0	19.0	0.0	0.0	0.0	0.0	0.0	19.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RNG	0.0	26.9	0.0	0.0	0.0	0.0	0.0	26.9
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASES	0	1	0	0	0	0	0	1

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RNG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASES	0	0	0	0	0	0	0	0

Table A4. Average Albedo (AVG), Average Texture (TEXT), Average Maximum Albedo (MAX), Average Minimum Albedo (MIN), and Average Range of Albedo (RNG) of the Seven Individual Stations and for an All Stations Composite for the Autumn Data of 1977 and 1978 for Ice Clouds. Standard deviations of the samples are listed below each average value. The number of cases is listed at the bottom of each cloud cover category (Cont.)

1.0 ICE CLOUDS AUTUMN

1977	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	42.2	53.1	0.0	0.0	0.0	44.9
	0.0	0.0	8.8	0.0	0.0	0.0	0.0	9.0
TEXT	0.0	0.0	7.0	1.9	0.0	0.0	0.0	5.7
	0.0	0.0	1.2	0.0	0.0	0.0	0.0	2.5
MAX	0.0	0.0	58.3	57.0	0.0	0.0	0.0	58.0
	0.0	0.0	11.1	0.0	0.0	0.0	0.0	9.6
MIN	0.0	0.0	29.8	48.5	0.0	0.0	0.0	34.5
	0.0	0.0	8.1	0.0	0.0	0.0	0.0	10.7
RNG	0.0	0.0	28.5	8.5	0.0	0.0	0.0	23.5
	0.0	0.0	4.9	0.0	0.0	0.0	0.0	9.6
CASES	0	0	3	1	0	0	0	4

1978	SYR	BUF	AVP	PHL	ACY	WAL	LYH	ALL
AVG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TEXT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RNG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASES	0	0	0	0	0	0	0	0